

Construction Methods

First Copy

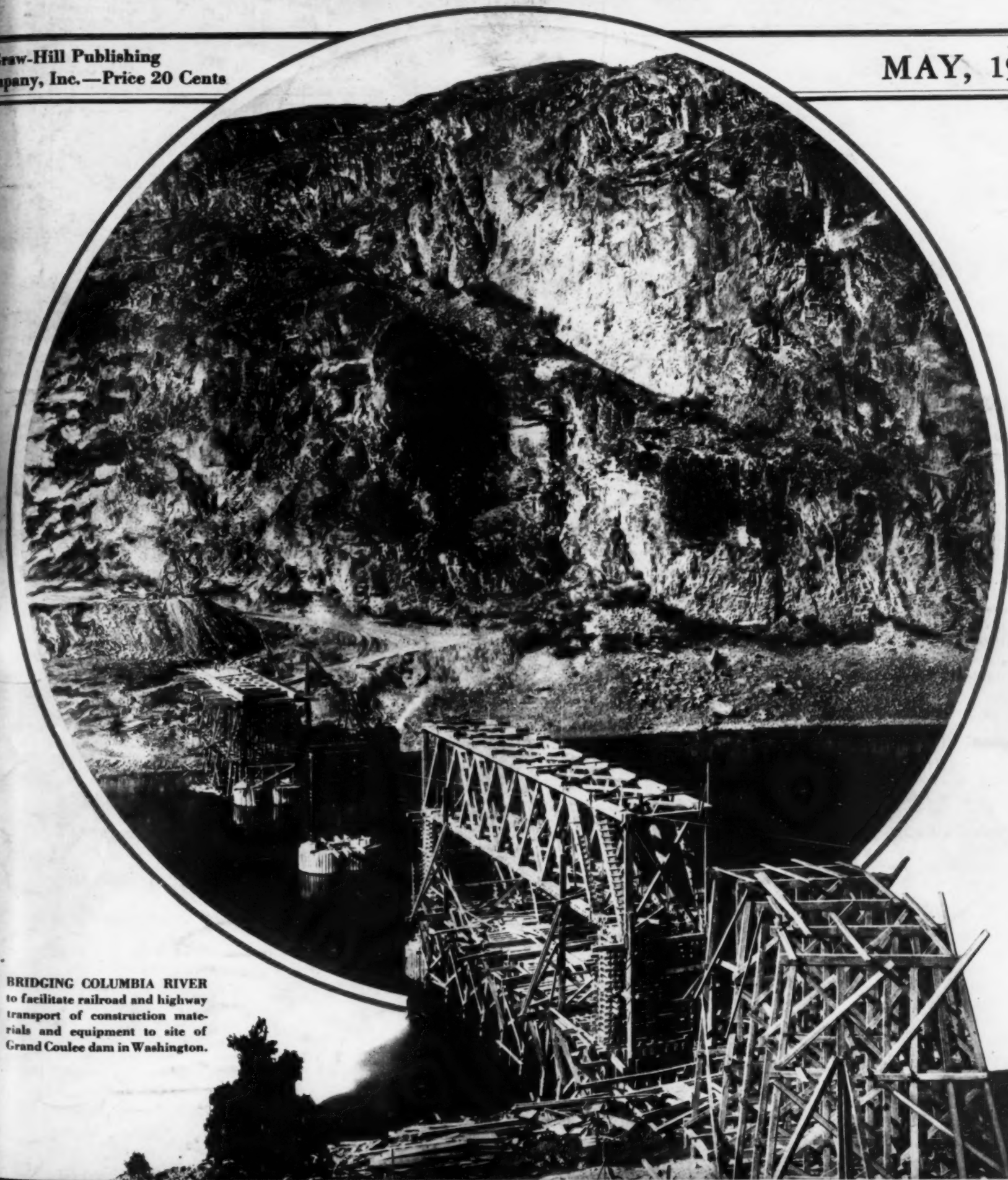
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MAY, 1935



BRIDGING COLUMBIA RIVER
to facilitate railroad and highway
transport of construction materials
and equipment to site of
Grand Coulee dam in Washington.



On a road-building contract near Towson, Md., "Caterpillar" Diesel Tractors slash the costs of moving earth from cut to fill

New records for economy and dependability, a new basis for the estimating of power costs—the performance of thousands of "Caterpillar" Diesel Tractors on hundreds of operations is making engineers and contractors sit up and take notice. Your dealer can show you complete, comparative figures on "Caterpillar" Diesels now at work, and let you put one to the test yourself. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

REG. U. S. PAT. OFF.

CATERPILLAR
D I E S E L

Four Billion for Work Relief

● Now that Congress has handed the President a \$4,880,000,000 "blank check" in the form of the Emergency Relief Appropriation Act of 1935, approved April 8 to finance the largest peace-time federal public works program in history, the interest of the construction industry is focussed on how the funds will be spent. To eight general classes of projects outlined on this page last month—of which highways and grade-crossing elimination (\$800,000,000), housing (\$450,000,000), local public works projects (\$900,000,000), reclamation and irrigation (\$200,000,000), and forestation, soil erosion prevention, rivers, harbors and flood control (\$350,000,000), are of direct concern to engineers and contractors—allocations totaling \$4,000,000,000 are specified in the act. Of this sum it is estimated that approximately 59 per cent—or \$2,355,000,000—will be disbursed for equipment and materials and 41 per cent—or \$1,645,000,000—as wages for labor.

Original fears that the program would be handled largely by day-labor instead of normal contract methods have been allayed by Section 8 of the act which stipulates that "wherever practicable . . . full advantage shall be taken of the facilities of private enterprise." The effect of this clause will be two-fold, for in addition to the jobs created on the site of the work undertaken by contractors' organizations it insures the reasonable use of equipment and materials, with a consequent stimulating effect on employment in the plants, quarries and mines of manufacturers in the so-called capital-goods industries, where employment has been at a critically low ebb for several years past.

Division Between Labor and Materials

● The foregoing figures, based on the allocations made by Congress, are intended to furnish only a rough estimate of the portions of the work-relief dollar that will go directly to labor and for materials, supplies, equipment and transportation. The average division between the two factors, of course, will depend on how much is spent for types of project on which the labor cost is high. Records of the Public Works Administration, for example, indicate that 34 cents of every dollar go to labor at the job site and 66 cents for equipment and materials. On present work-relief projects, however, labor gets 90 cents of every dollar, but in the new program a larger share will be spent for materials. Highway construction, the records show, gives labor at the site 30 cents out of each dollar. The highway program for the next two years, by the way, will reach a total exceeding \$1,500,000,000, made up of the \$800,000,000 allocated by the present work-

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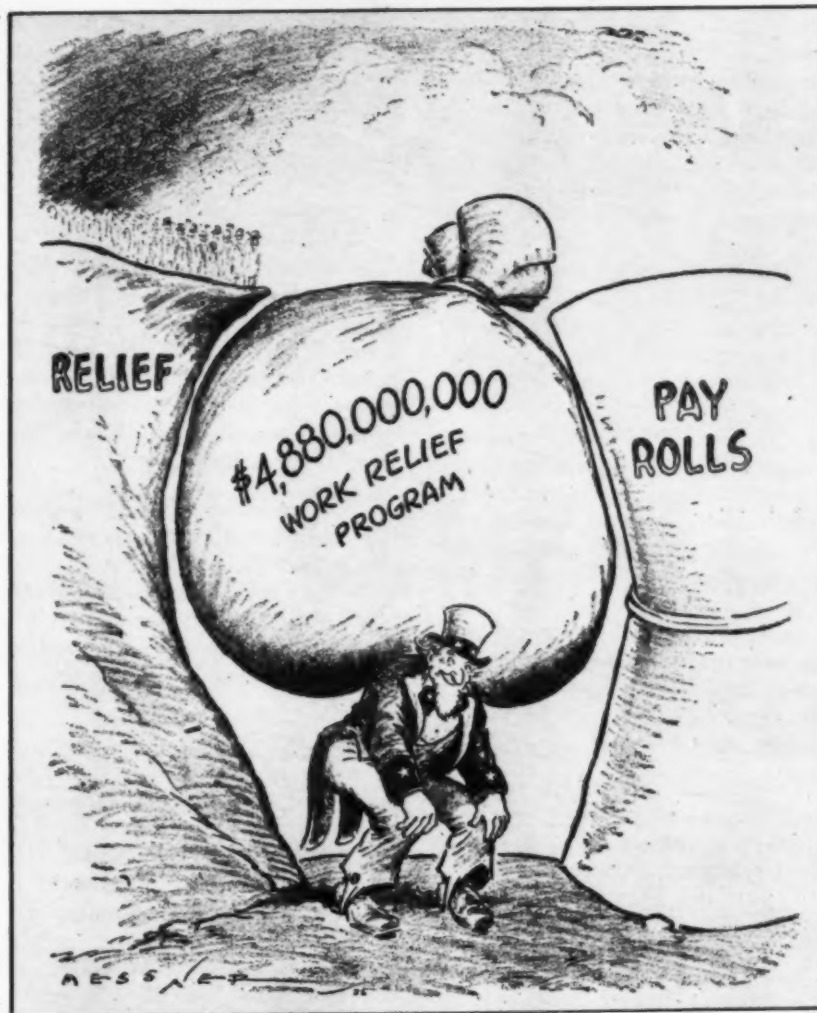
McGraw-Hill Publishing Company, Inc.,
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ROBERT K. TOMLIN,
Editor

MAY, 1935

WILLARD CHEVALIER,
Vice-President

Editorial Staff: Vincent B. Smith, N. A. Bowers (San Francisco)
Leonard H. Church (Cleveland), Nelle Fitzgerald



Messner, in the Knickerbocker Press, Albany, N. Y.

Now They Can Cross

relief appropriation, plus \$250,000,000 of regular federal-aid construction, \$480,000,000 that the states will contribute and \$52,000,000 remaining from last year's Congressional appropriation of \$200,000,000.

Speed Essential

● If the program is to be effective in accomplishing its purpose of reemploying 3,500,000 workers, speed in getting the projects under way is vital. A repetition of PWA's dilatory procedure in handling the \$3,300,000,000 program provided for in the National Industrial Recovery Act would be intolerable. With the spring season already at hand further delays will deprive the administration's new drive for recovery

of its hoped-for quick and stimulating effect. The PWA program gave clear evidence that procrastination at the outset can never be overcome.

Direct Work on Non-Federal Projects

● The compromise reached in the Senate-House conference committee on the \$900,000,000 allotment for local non-federal projects (waterworks, sewers, etc.), which requires that 25 per cent of any loan or grant, or both, made for any project shall be spent for "work," will not raise any serious obstacle to undertaking heavy construction of the character previously financed by PWA. This broad limitation was adopted when the administration objected to the

provision written in to the bill by the conference committee which would have disqualified any project that did not embody 30 per cent of its cost in direct labor.

Presidential Direction

● In assuming personal direction of the program the President has accepted responsibility for the result. The mechanics of engineering and construction remain much the same as in the past. Federal projects either will be undertaken by existing government agencies which receive the allotments or will be supervised by them. This provision places the work in the competent hands of such organizations as the U. S. Bureau of Public Roads, the Corps of Engineers of the Army, the U. S. Bureau of Reclamation and others. Non-federal projects will be handled by PWA. Time scheduling is counted upon to provide a momentum that the old public-works program never gained. The emphasis on speed is explained by the President's declared purpose to spend the \$4,000,000,000 appropriation by July 1, 1936.

Highway Contractors Code Approved

● After unconscionable delay Chapter II C of the Construction Industry Code, covering operations of the Highway Contractors Subdivision, was finally approved March 16 and became effective March 26. Except in the cases of watchmen, job or field clerks and supervisory employees, it carries the same hours and wage provisions as the general code—a 40-hour week and 40 cents an hour minimum wage—and is to be administered by a committee of 13 members, 8 representing construction association (A. G. C.) members and 5 non-members. Provision is made for area agreements between groups of employers and employees covering hours of work and rates of pay.

The code contains two trade-practice provisions, one prohibiting financing of contractors' accounts by subcontractors, surety companies or material vendors, unless expressly provided for in the original contract; and the other making visiting contractors bound by all the rules, regulations and agreements for other contractors. The Code Authority will appoint state administrative committees, formulate cost-accounting standards, prescribe rules for fair competitive bidding and the renting of road-building equipment.

While a Highway Contractor's Code is now in effect, its influence on present and prospective work will be almost negligible, in as much as practically all road-building work in progress or planned for the immediate future is financed wholly or in part with federal funds and is controlled by regulations of federal and state bodies which conflict with and supersede code requirements, particularly with regard to wage rates and hours of labor.

Sound Counsel from the Construction Industry

AS THIS IS written the President is announcing from time to time his plans for administration of the work-relief act. Necessarily, perhaps, his announcements are in broad terms that have offered to date but slight indication of just how the program will work out in detail. Certainly they have answered definitely but few of the questions that have been bothering the construction industry ever since the President first broached his work-relief program.

For that matter, it is doubtful whether any program, however detailed, could dispose of those questions. The success of so vast a program, with its multiple objective, involving so many industries, operating in so many regions and communities and functioning through so many agencies, must depend in the long run on the men who operate it. As every practical constructor knows, a well-informed, competent and resolute administrator, holding steadfastly to his essential objectives, can get results in spite of a misbegotten organization plan; on the other hand, the most carefully contrived plans and regulations can, under inept or otherwise inadequate administration, become a strait-jacket on progress and a disastrous obstruction to accomplishment. The President has chosen construction as the major vehicle through which to advance his relief and recovery purposes; his success will be determined by the skill with which Messrs. Walker, Hopkins, Ickes, Tugwell and Peoples energize and direct that vehicle.

IN VIEW of the important role thus assigned to construction and its dependent industries, it is to be hoped that in the direction of this effort the President and his aids will draw heavily on the services of men who are versed in the structure and practice of that industry. However honest, intelligent and otherwise qualified as administrators-in-general, none of the key men thus far assigned to the job is distinguished for demonstrated capacity in the practical operation of the construction function. Indeed, some of their acts and expressions have revealed a misapprehension of various operating conditions which indicates the need for some expert counsel and guidance in an undertaking that requires the effective integration of so many specialized functions. To invite and use such help on so vital and complicated a task could not be construed as a confession of inadequacy; rather would it be convincing evidence of administrative discernment and competence.

To those officials into whose hands the President thus has entrusted the well-being of the construction

industries, as well as the ultimate success of his administration, this writer would commend the report of the Construction League* which suggests policies for effective administration of the work-relief program insofar as it involves construction.

This report makes available the mature thought and judgment of several committees, each well-informed in the practical operation of some department of the construction industries. Here is no place to review its recommendations in detail. But it should be said that these are broad-visioned, conservative, rational and practical. They keep consistently in mind the President's relief objectives; at the same time they recognize the requirements of normal recovery and avoid any procedure that would undermine the stability of the several construction industries through which those objectives must be achieved.

They include policies to govern the hiring of labor, the retention of professional services, the award of contracts and the procurement of materials, all formulated with due respect to their effects on industrial recovery, efficient administration of the public funds and practical operation, as well as the more immediate and urgent task of expanding employment.

IN THIS effort to help the administration make the most of its work-relief program the Construction League deserves the endorsement and aggressive support of the entire construction industry: engineers, architects, contractors, producers and distributors of equipment and materials all have a vital stake in its success. Strong and prompt supplementary support for this unified effort by each of the specialized groups that compose the industry will do much to convince the administration that the proposed policies are generally accepted as sound by those who know the industry.

And that, in turn, should help it to see clearly that the successful use of the construction industry as a relief and recovery agency will depend chiefly on its adherence to these policies.

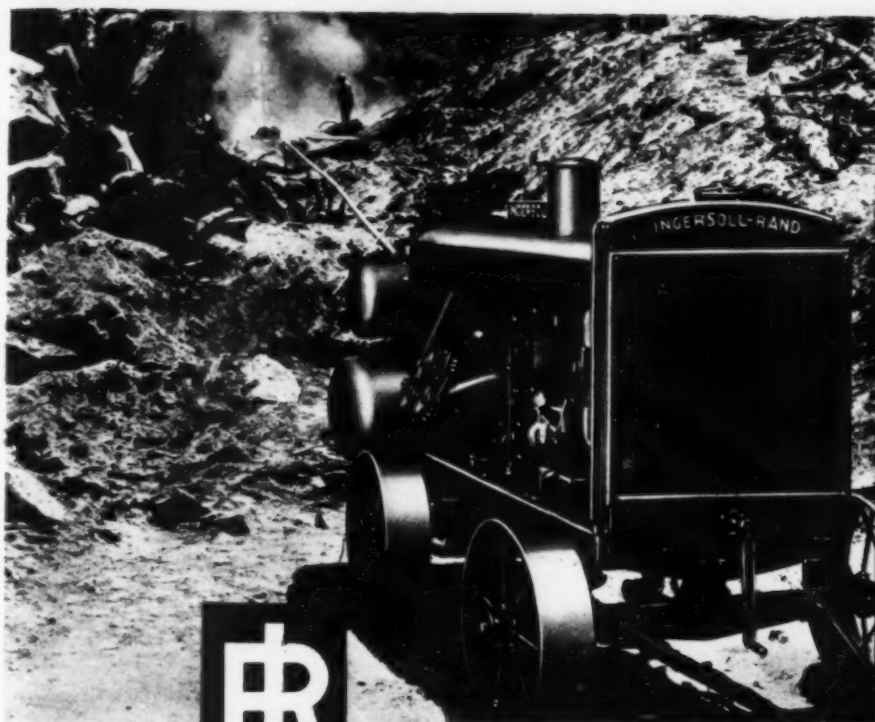
Willard Chevalier

*"Recommendations for Construction under the Work Relief Act"—Construction League of the United States, National Press Building, Washington, D. C.

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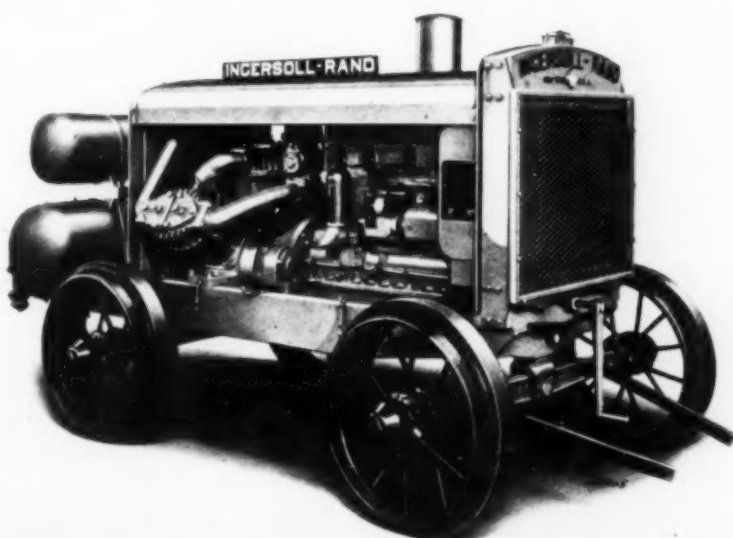
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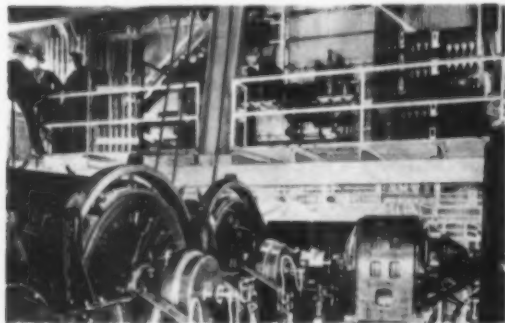
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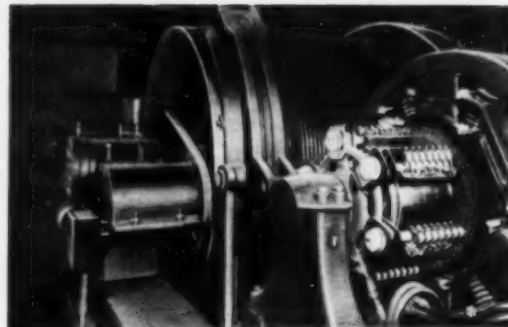
CABLEWAYS View of G-E motor and control equipment in head tower of Lidgerwood cableway at Norris Dam. G-E controls keep towers in line, and make possible swift, accurate operation.



Ballasting the track for head towers (in background) of cableways at Bonneville Dam. These cableways are completely G-E equipped, as are those at Norris Dam and Boulder Dam.



G-E equipped Clyde Wiley Whirley (with 95-foot boom removed) for concrete placing at Gen. Joe Wheeler Dam. Other Clyde Wiley Whirlies, equipped with G-E motors and control, will be used at Grand Coulee Dam and on other jobs.



HOISTS G-E 250-hp. motor geared to hoist drum used in construction of Water Tunnel No. 2 for New York City. Sixteen of these equipments removed approximately 2,400,000 yards of broken rock from the tunnel through shafts varying in depth from 480 feet to 780 feet. This and other G-E equipment on this job paid Patrick McGovern, Inc., the contractor, big dividends in time saved.



CRANES Two of four G-E equipped American Revolvers built by the American Hoist and Derrick Company for handling all cement and aggregates at Gen. Joe Wheeler Dam. Similar equipments are in use at the San Francisco-Oakland Bay Bridge and on other projects.

G-E SERVICE

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IN THE WORDS

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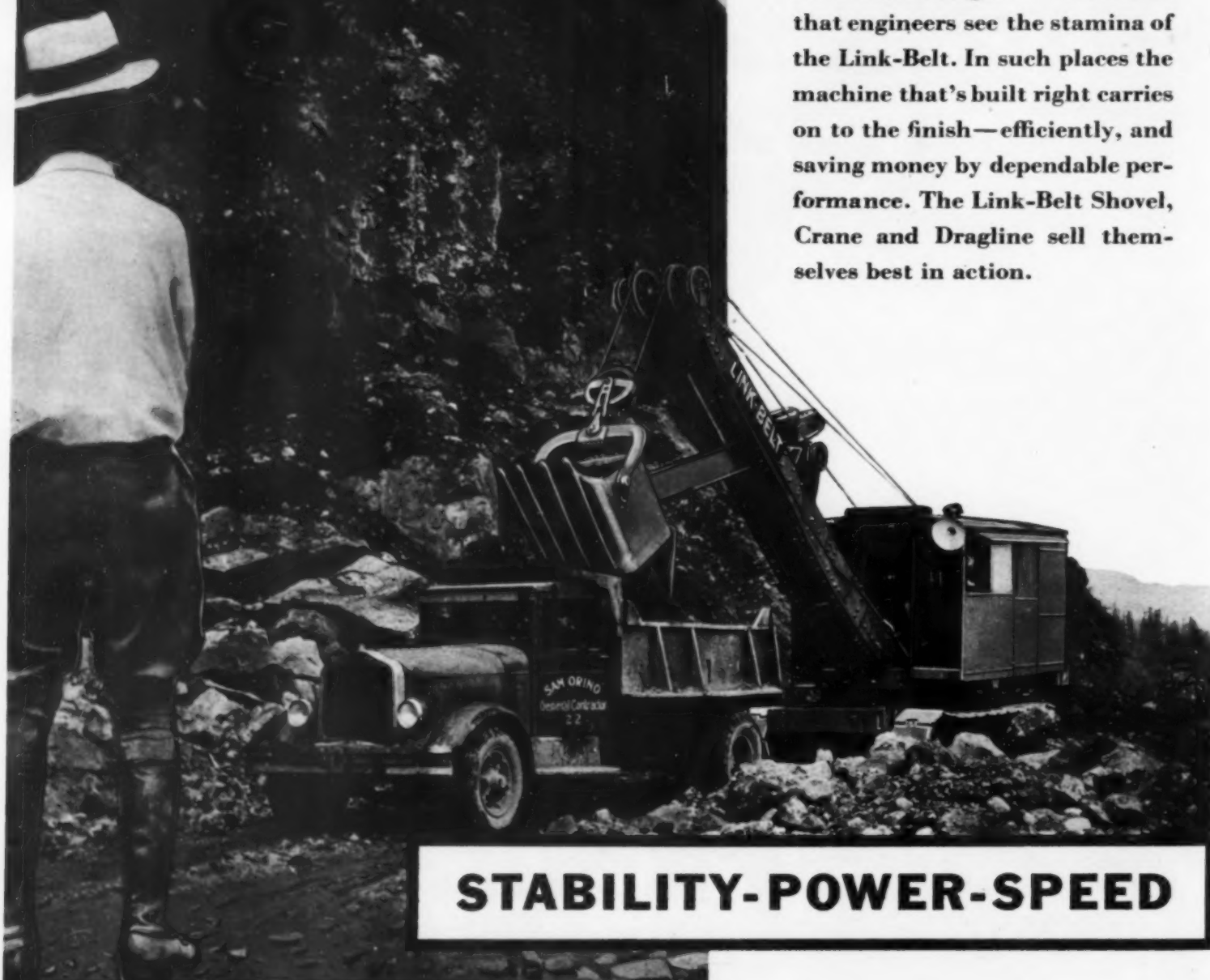
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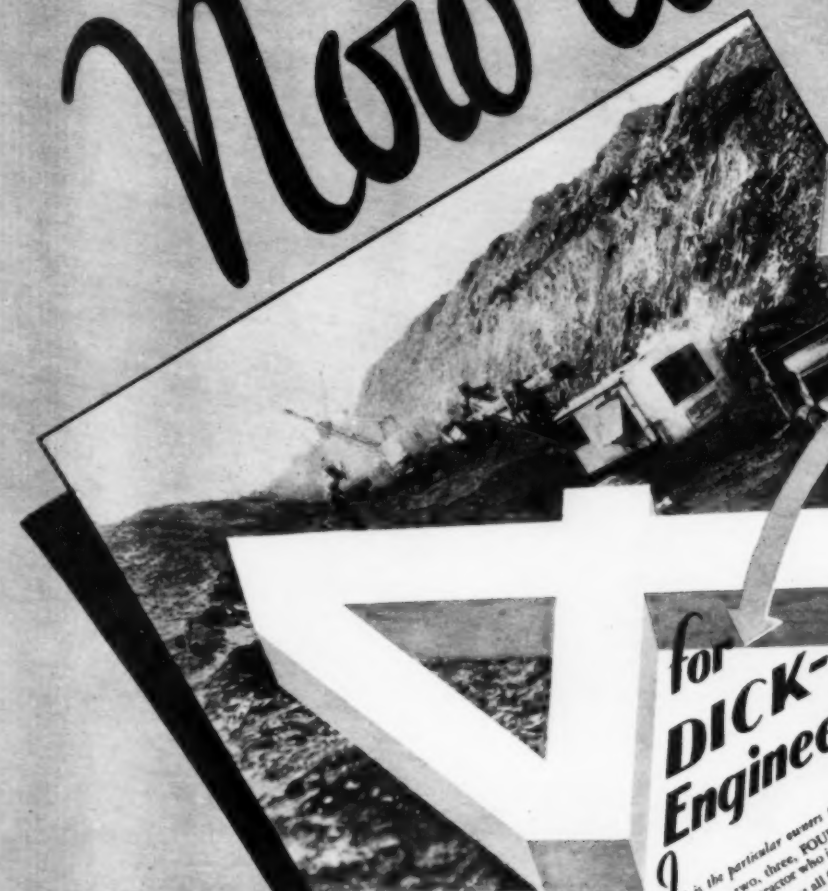
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Page 14

May, 1935—CONSTRUCTION METHODS

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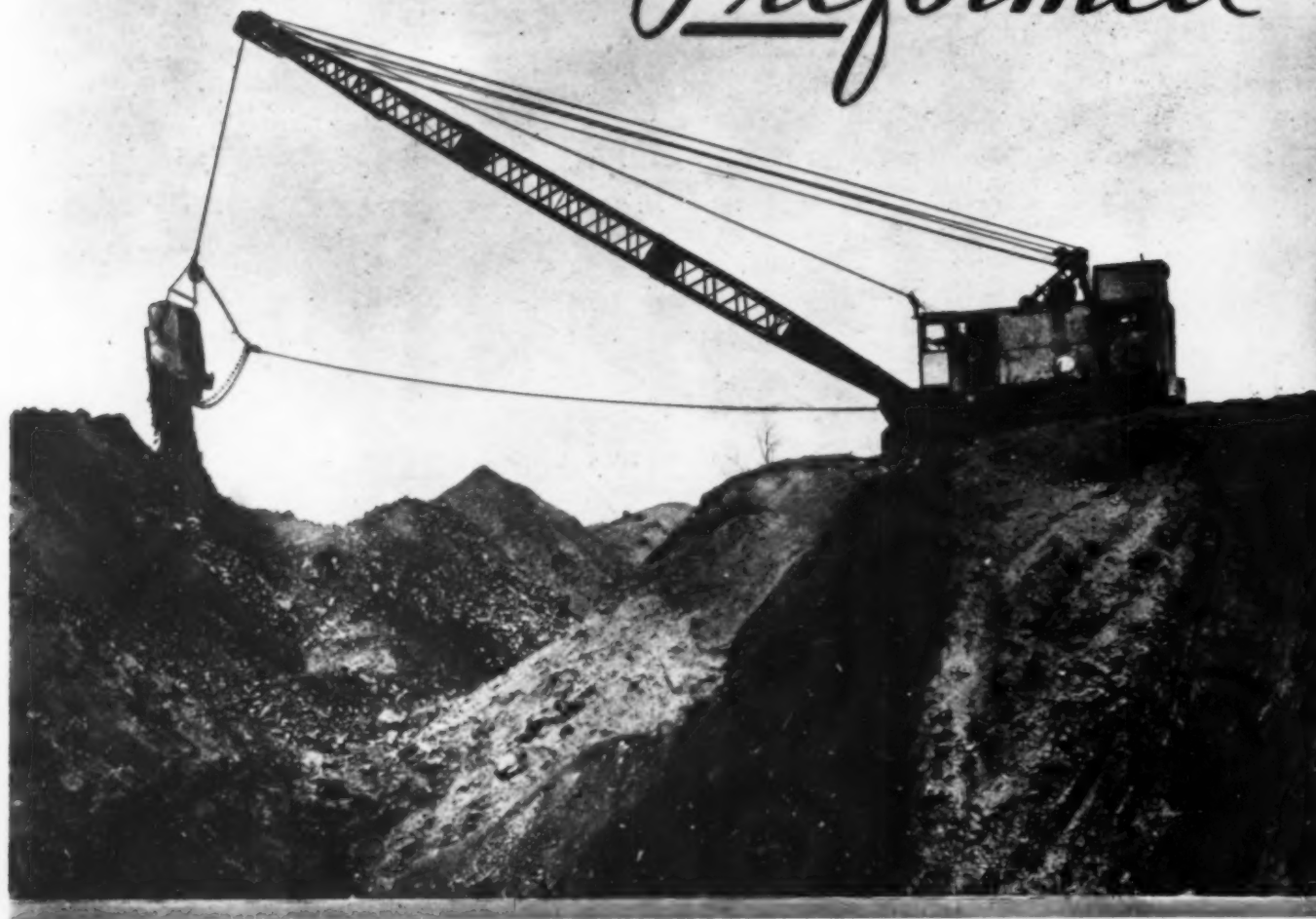
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OUTLASTS THE BUCKET TEETH

● On this job Tru-Lay Preformed Wire Rope gave 520 hours of service—in work so hard it ruined the bucket teeth faster than it wore out the rope.

The job is removing 35 feet of overburden from an Indiana coal mine. This overburden is so hard the bucket has to fight its way through by constantly being jerked. A more severe test of wire rope would be hard to find.

One non-preformed rope lasted only

one day; the best non-preformed rope "took it" for only 10 days. Tru-Lay Preformed went on 12/18/34—came off 2/1/35. 520 working hours of service! At the time this ad is written the second Tru-Lay Preformed Rope is still in service.

Needless to say, Tru-Lay Preformed is very popular at this operation. Tru-Lay Preformed would be very popular at *your* operation, too. Send for complete information.

AMERICAN CABLE COMPANY, Inc.

Wilkes-Barre, Pennsylvania

In Business for Your Safety

District Offices: Atlanta, Chicago, Denver, Detroit, New York, Philadelphia, Pittsburgh, Houston, San Francisco



TRU-LAY * *Preformed* Wire Rope

* PREFORMED ROPE IS MADE IN ALL TYPES, GRADES, CONSTRUCTIONS AND LAYS

OUTPUT increases materially when modern Bucyrus-Eries are put on the job. They have the speed and power to hustle through tough going. They have controls so responsive and easy to handle that continued smoothness and accuracy of operation can be maintained over long periods. Their durable construction assures steady performance with delays a rarity. Their modern output means profit for you.

output



**BUCYRUS
ERIE**

BUCYRUS-ERIE

EXCAVATING, DRILLING, AND MATERIAL-HANDLING EQUIPMENT...SOUTH MILWAUKEE, WISCONSIN

CONSTRUCTION METHODS—May, 1935

Page 17

A BETTER BLACKTOP PAVEMENT *with* OVERLAPPING CUTTER BAR ACTION



THE ADNUN BLACK TOP PAVER makes a positive, mechanically accurate joint without the variations that occur where manually set bleeders and blenders are used.

- The Adnun Cutter bar makes the joint by *overlapping action* putting pressure on the material as it abutts the joint assuring a true joint the *full thickness* of the material.

- The texture of the road surface is not changed at the joint but is equal in quality to the center of the course. This cannot be the case where hand set leveling devices are dragged over the unrolled course.

- As the Adnun travels on the finished course it provides its own template set to gage assuring the maximum in course accuracy. There are no runners to drag and mar the pavement and a highly finished subgrade is not required.

- These are exclusive Adnun advantages that mean better Black Top Roads.



Northwest Roads Co., using an Adnun Black Paver on street work in Tacoma, Washington.

THE FOOTE COMPANY, INC.
NUNDA, NEW YORK

ADNUN
TRADE MARK REGISTERED

*World's Largest Exclusive
Builders of Road Pavers*

BLACK TOP PAVER



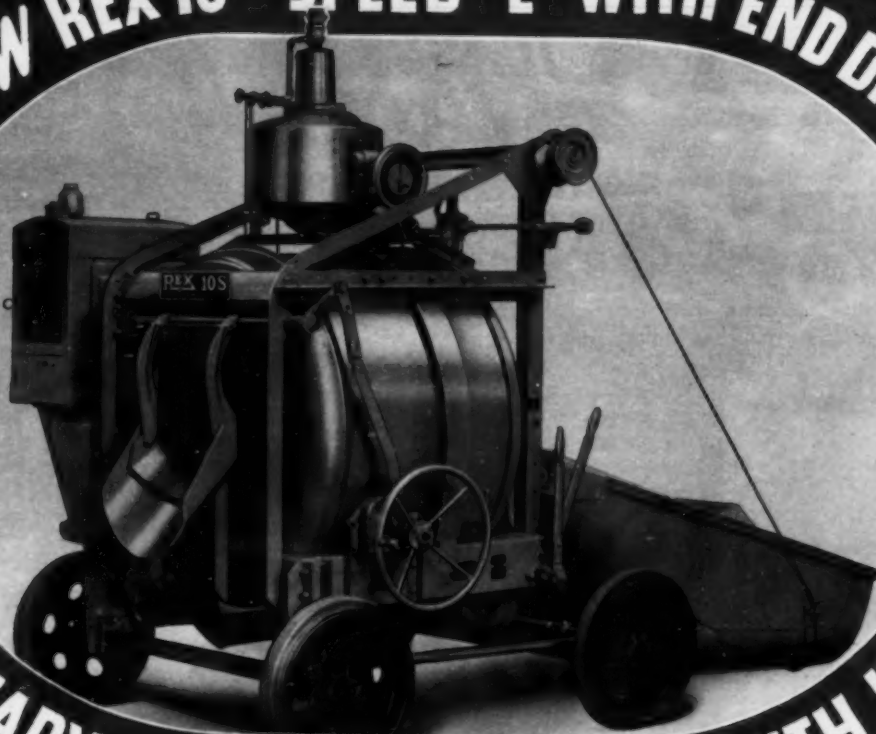
FOOTE ENGINEERS

have kept pace with concrete road problems. The MultiFoote Paver is absolutely up to the minute—the latest thing in concrete pavers. When you are in the market ask about its 10 points of superiority.

Showing

*A
Bridge
Builder's
Special*

THE NEW REX 10- SPEED "E" WITH END DISCHARGE



— IT'S READY BE READY WITH IT
to Meet Modern Job Conditions and Prices

● Here it is—a new Rex—built on the Rex High Speed, lightweight principle . . . with all those original Rex features that made the Rex 10-Speed "S" the model of the industry.

Those original Rex Features—

- ★ 7-second Shimmy Skip
- ★ 7-second Discharge
- ★ Pressed Steel Drum
- ★ Pressed Steel Timken Drum Rollers
- ★ Governor Booster
- ★ Unit Power
- ★ Group Controls
- ★ Roller Bearing Wheels
- ★ Automotive Steering for Fast Towing
- ★ Proper Balance
- ★ Rex-O-Meter

And where else do you get them all, plus vertical water tank—four wheels for fast, safe towing, three-point suspension, short wheelbase—end discharge—quick maneuvering up to any discharge point—as light or lighter than any 10-S or 10-E on the market?

The Rex 10-Speed "E" is a Bridge Builder's Special—you can back it right up to the job—pour directly into side walls.

You know Rex—you know Rex quality—you will want to know more about this new Rex. It is modern, with it you can compete—get lower costs than any other way, on any job that calls for a 2-yard mixer. Send for the book, "Speed—Speed—Speed with Rex High-Speed Mixers" that tells you all about it. Use coupon.



*Carried in Stock
in Principal Cities*

CHAIN BELT COMPANY, 1664 West Bruce Street, Milwaukee, Wis.

Home Office—Central and Northwest Divisions

Eastern Division: 529 Chrysler Bldg., New York, N. Y.

Southern Division: 3704 Lexington Ave., Dallas, Texas

West Coast Division: 909 Harrison St., San Francisco, Calif.

CHAIN BELT COMPANY

1664 W. Bruce St., Milwaukee, Wis.

Please send me the Catalog "Speed—Speed—Speed with Rex High-Speed Mixers."

Name.....

Firm Name.....

Address.....

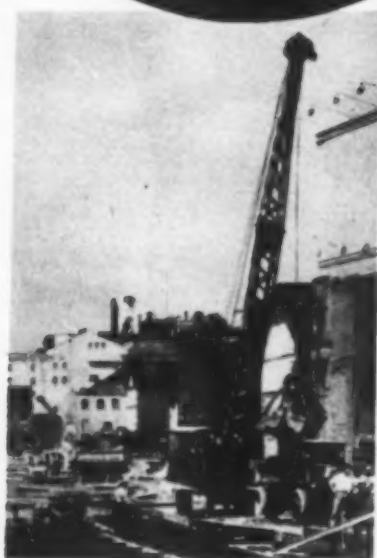
City..... State.....

REX CONSTRUCTION EQUIPMENT

KOEHRING

**11
KOEHRING
CRANES
on**

this job



BUILDING THE APPROACHES AND SUBWAYS FOR PHILADELPHIA-CAMDEN HIGH-SPEED LINE * * *

Contractors, engaged in the construction of the subways and approaches for the High-Speed line of the Philadelphia-Camden Bridge — chose Koehring Equipment, to reduce costs and increase production.



KOEHRING COMPANY

Pavers · Mixers · Shovels · Cranes · Draglines · Dumpers · Mud-Jacks
3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN



CONSERVE THE STRENGTH OF YOUR ROPE

Know your Ropes

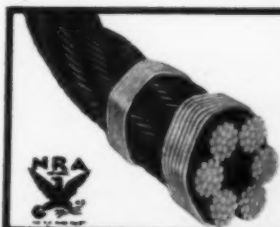
...This is a helpful hint, how to make wire rope last longer. Subsequent Wickwire Spencer advertisements in this publication will give other dollar saving information. Tell us about your rope problem and we will give you the answer.

A wire rope loses in breaking strength when it is bent over a sheave. If the sheave is relatively small in relation to the rope diameter, the loss in strength is considerable. With sheaves of greater diameter, however, the loss becomes so slight that it is hardly worth considering. Proper diameter of sheaves minimize the loss of rope strength from bending. We will gladly send you a table showing the proper relationship between rope and sheave diameters. Write today and request this or any other information that may be of help to you in making rope live longer.

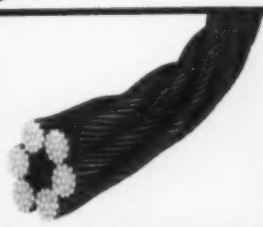
WICKWIRE SPENCER STEEL COMPANY, New York City; Buffalo, Chicago, Worcester; *Pacific Coast Headquarters:* San Francisco; *Warehouses:* Portland, Los Angeles, Seattle. *Export Sales Department,* New York City.

WIRE ROPE

by Wickwire Spencer



BOTH...STANDARD LAY AND WISSCOLAY PREFORMED. *Wickwire Spencer manufactures all sizes and types of Wire Rope in standard lays and preformed. Wisscolay preformed wire rope will often solve a wire rope application difficulty. Ask our engineers where and when it should be used. Send for a free WIRE ROPE BOOK. It will prove of great value.*



**CONTRACTORS
SAY - GIVE ME**



FOR

fast

**DIRT MOVING
OPERATIONS**

MODEL 87Q HUG ROADBUILDER

● Equipped with special elevating grader and dirt body. Powerful 6-cylinder truck engine. Full Diesel power optional. Heavy duty transmission with 10 speeds forward, 2 speeds reverse. Special heavy duty; double reduction rear axle. Rugged 8-inch "I"-beam frame. Special ground-grip pneumatic tires. Passenger car ease of steering and Sponge-Air seat cushion for easy riding. Equalized load distribution and many other features, including the famous Hug front-axle rocker action that enables Hugs to get over rough ground with greater speed and ease, without twisting and bending frame, radiator and hood.



● Actual experience of many contractors proves beyond any question that HUG Roadbuilders offer the fastest and most economical dirt moving equipment in the whole heavy duty dump truck field. In fact, Hug Roadbuilders will move more yardage for less money whenever it is profitable to operate any type of equipment at all.

Hug Roadbuilders will speed up your operations—carry you through on schedule, and be ready to whip your next contract regardless of conditions because Hug's roadbuilding experience is built into Hug Roadbuilder Trucks! This is why Hugs are out in front of the whole dirt moving field.

Hug Roadbuilder trucks are not limited to one phase of roadbuilding work, but are flexible transportation units. When the grading is finished, they can be easily adapted to batch hauling to the mixer or from the central mixing plant. And, best of all, they operate with equal economy on dirt, gravel, rock or batch hauling.

Let your Hug dealer show you why Hug Roadbuilders lead the dump truck field. Or write us today and we will send you complete information on this or any other Hug model.

THE HUG COMPANY

512 CYPRESS STREET • HIGHLAND, ILL.



● One of a fleet of 7 Model 87Q Hug Roadbuilders operated by James Spencer & Son Construction Company, Gilmer, Texas. Used on new location state highway grading work. These Model 87Q Hug Roadbuilders averaged 300 cubic yards of pay dirt per truck in ten hours on a one-mile haul.

"BUILT TO MEET A CONDITION"

THE WALLOP to knock down your DIRT MOVING COSTS!



● It's not how much dirt you move that counts . . . it's the cost of moving it! That's where the Bantam Weight steps into the picture . . . digs its way to profits where larger machines can't. It's full revolving and mighty husky all around. Every waste pound is trimmed off to guarantee fastest production at lowest operating costs. As shovel, it weighs only 15,800 pounds. Fully Convertible at lowest cost ever for service as shovel, dragline, crane, hoe, skimmer or pile driver. Simplified design of attachments makes converting practical right on the job.

P&H BANTAM WEIGHT (MODEL 100 $\frac{3}{8}$ YD.)

● With the smooth Ford V-8 power plant, the Bantam Weight gets there in a hurry and works effectively in tight corners. Split Second Power Clutches, P&H Rapid Reversing Chain Crowd and live boom provide easy control for fast digging; with accuracy to within 1 inch of grade.

All Welded Construction and new alloy steels have reduced weight to a new and unbelievable degree . . . at the same time adding strength and controlled balance. Machinery units are placed far behind the center of rotation.

Economical first cost is combined with lower upkeep. First reduction helical gears are heat treated and double cut for long life and operate in an oil bath. Anti-friction bearings are used at all vital points. Rigid frame construction prevents weaving and misalignment. Dependable Ford V-8 may be renewed on Ford replacement plan. . . Full Vision of 210 degrees is provided in comfortable streamline cab with sliding door and windows.

BULLETIN No. 100

has complete details. A post card will bring your copy.

HOW THE BANTAM WEIGHT MEASURES UP:

Capacity	$\frac{3}{8}$ -yard
Engine	Ford V-8 (40 HP)
Weight (as shovel)	15,800 lbs.
Swinging Motion	P&H Rapid Reversing
Clutches	Split Second Control
Swing Line Speed	162 F.P.M.
Dragline Speed	150 F.P.M.
Travel Speed	5 RPM
Tail Swing	$1\frac{1}{2}$ to 3 MPH
Height to Top of Cab	7 Feet
	10 Feet 4 inches

HARNISCHFEGGER CORPORATION

4494 W. National Avenue
Warehouses and Service Stations: Hoboken

Established 1884
Branch Offices in Principal Cities of the World: Memphis, Jacksonville, Milwaukee, Wis., Seattle, Dallas, Los Angeles, San Francisco

EXPLOSIVES WON'T SETTLE EVERY HIGHWAY SWAMP FILL

*But They Do Furnish the Solution on
Many Swamp Roads*

Loading Fill Settlement Shot



Wiring up Electric Blasting Caps for Fill Settlement Shot



The blast. Note absence of fill throwing. Gases are properly confined to push mud laterally from under fill

Different kinds of "mud"—different depths of "mud"! Different water conditions—different widths and kinds of fill! These—and other factors—necessitate careful consideration in the selection of fill settlement methods.

Recently the use of explosives has become more widespread in removing or liquefying swamp "mud" to permit highway fill to settle into stable position on solid bottom. Here's work that demands the proper method and the right explosive—and Atlas offers you real help in selecting both.

Blasting underneath the fill must be controlled to avoid wasting fill as the tremendous forces of explosive gases push the mud away. A good deep fill shot provides a heavy, bearing action that is not spectacular or noisy.

Atlas has developed a new method of directing the forces of the explosives laterally to get maximum removal of mud from under the fill. It involves the use of the new Atlas Twin Fifty Electric Blasting Machine. Atlas representatives will be glad to discuss this new idea with Highway Engineers—and cooperate, not only before the job is started, but throughout its progress.

These photographs show fill settlement work at Ha Ha, Maryland, under the direction of Mr. E. L. Mustard



After Fill Settlement Shot

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

OFFICES

Allentown, Pa.
Boston, Mass.
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Spokane, Wash.
St. Louis, Mo.
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ATLAS

EXPLOSIVES



TRUCK MIXER TO FORMS

"Via Barber-Greene"

This Barber-Greene Conveyor is handling the concrete for oil tank foundations. After ten foundations and sidewalls were poured, the swivel spout was removed, and the same Barber-Greene elevated all of the concrete in pouring a 14' wall all around the property.

But the important thing is that Barber-Greene Belt Conveyors are used for handling concrete in almost *every* phase of construction, including:

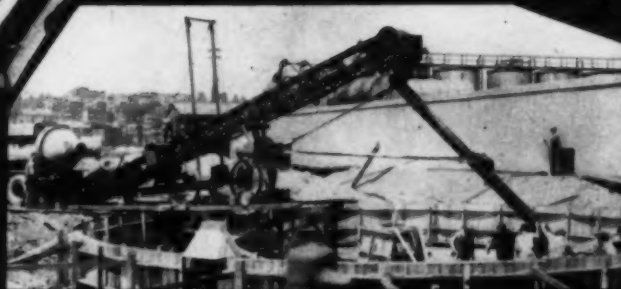
PIERS
DAMS
LOCKS
WALKS
SEWERS
BRIDGES
TUNNELS
VIADUCTS
STADIUMS
BUILDINGS
PAVEMENTS
ELEVATIONS
RETAINING WALLS
IRRIGATION DITCHES

We maintain a department for the sole purpose of aiding in laying out concrete handling jobs. Write us about your next job.

BARBER-GREENE COMPANY
530 West Park Avenue
Aurora, Illinois

35-7

**BARBER
GREENE**



Another important thing is a copy of "Concrete Handling" that we have for you. A card or letter will bring it. It is the most comprehensive booklet ever published on the handling of concrete with belts, and it is full of job pictures.

ILLINOIS STEEL SHEET PILING *in the Heart of the Andes*



A general view of the dam site, showing the Steel Sheet Piling, supplied by the Illinois Steel Company, being driven in connection with the construction of the concrete Cut-Off-Wall for the Rock-Fill Dam. The river which was diverted through tunnels and the temporary diversion dam are visible in the background, while the extent of the cut necessary for the construction of the Cut-Off-Wall and Main Dam is clearly evident in the foreground. This work was carried out at an elevation of between 12,000 and 13,000 feet above sea level.



Looking down into the sheathed trench from the downstream side. The steel waling and crossbracing, which were carefully placed and largely welded, are shown.

● Evidence of the sturdiness of Illinois Steel Sheet Piling is found in this installation, made under unusually difficult conditions by the Cerro de Pasco Company in Peru. The piling was driven in the construction of a power dam.

As will be seen in the accompanying photographs, driving conditions were severe. But in spite of difficulties, the installation proved most satisfactory.

ILLINOIS STEEL COMPANY
208 SOUTH LA SALLE STREET, CHICAGO, ILLINOIS
CARNEGIE STEEL COMPANY, PITTSBURGH

United States Steel  *Corporation Subsidiaries*

FOR LOWER HAULING COSTS

*Maximum Load
Well Distributed
Quickly Dumped*



Hydraulic controls from the cab dump the body to (either side) while drop doors act as a chute to clear the load.



The 6 cubic yard model is illustrated above. Hopper Type (Bottom Discharge) models are also available in capacities of 10, 16, 20 and 25 tons. Side Dump models for 12 and 20 cubic yards.

The Austin-Western Trail Car for 1½ and 2-ton truck-tractors

● The Trail Car cuts hauling costs by increasing the pay load, thus reducing the number of hauling units required on the job. It takes double the load that a conventional truck can carry on its own chassis, yet its dimensions and maximum load conform to every state limitation of semi-trailers.

A full universal fifth wheel provides a short turning radius, eliminates strains when hauling across uneven surfaces and permits the carrying unit to take all shocks when loading.

The hydraulic side dump is controlled from the cab by the driver, and the unlimited clearance plus a steep discharge angle make the dumping operation simple and rapid.

Trail Cars for truck-tractors of every make and power are also available. Use the coupon for information on the one described above or any other size and design you require.

The Austin-Western Road Machinery Co.

Home Office: Aurora, Ill.

Cable Address: AWCO, Aurora

Branches in Principal Cities



Above illustration shows the Trail Car servicing an Austin-Western Elevating Grader.

ROAD GRADERS · MOTOR GRADERS · ELEVATING GRADERS · DRAGS

Austin-Western

BITUMINOUS DISTRIBUTORS · ROAD-MIX MACHINES · CULVERTS · SCARIFIERS · BULLDOZERS · TRAILERS · SCRAPERS · PLOWS

CRUSHING AND WASHING PLANTS · SWEEPERS AND SPRINKLERS · SHOVELS · CRANES · ETC · SNOW PLOWS

The Austin-Western Road Machinery Co.
A-6 Aurora, Illinois
Send details on the ☐ 8-ton Trail Car;ton Trail Car.

Name.....
Address.....
City..... State.....467



DUMP CARS

DUMP
WAGONS

the Success Story of White Concrete Traffic Markers

They cost less. They are more efficient. That is the simple success story of white concrete traffic markers.



Why do they cost less? Because these markers are made of solid white concrete, *built* into the pavement. They never need replacement. The installation cost is the *only* cost.



Why are they more efficient? Because they have a dense, hard, stain-resistant, white surface. They never fade out. They never wear away. They are *always* white, day and night—always on the job, good weather and bad.



Hundreds of miles of white concrete traffic markers (like those on this bridge in Wichita, Kansas, installed by the Kansas State Highway Dept.) are today proving this success story of less cost, greater efficiency. Want the details? Write Universal Atlas Cement Co. (*United States Steel Corporation Subsidiary*), 208 South LaSalle Street, Chicago.

ATLAS WHITE TRAFFIC MARKERS
Made with Atlas White Portland Cement—Plain or Waterproofed

Construction Methods



ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc.

Volume 17—Number 5—New York, May, 1935



MASS HOUSING

Hillside Project in Bronx, New York, Financed by PWA

NEARING COMPLETION is the \$6,000,000 low-rent Hillside Homes housing development in the Borough of the Bronx, New York City, financed with PWA funds as a limited-dividend corporation project. Built by the firm of Starratt Bros. & Eken, Inc., of New York City, the project will provide living accommodations for 1,388 families on a site of 14½ acres located along the Boston Post Road at 214th St. The structures forming the large-scale development are mainly of the four-story, "walk-up" type, although the central unit of the group is a seven-story building equipped with elevators.

Ground for the foundations of the building group was broken April 19, 1934, marking the start of the second PWA limited-dividend project—the

first one being the apartment development known as Boulevard Gardens in Woodside, Borough of Queens, New York City. On the Hillside project, for which Clarence S. Stein, of New York, designer of the completed model town-

planning development at Radburn, N. J., served as architect, the buildings cover approximately 34 per cent of the area of the site, the remainder being occupied by gardens, playgrounds and wading pools. Fireproof construction

is employed throughout, with brick walls and concrete floors for all of the buildings.

While not a slum-clearance project—as the buildings were erected on an unoccupied site near the northern limits of the city—the development is designed to afford modern living accommodations at moderate rentals, originally estimated to average about \$11 per room per month. It is expected that the first units of the group will be ready for tenant occupancy this month.

For Starratt Bros. & Eken, Inc., the general contractors, John W. Bowser served as construction superintendent at the site, with Andrew J. Eken, president, and Russell H. Hunter, vice-president, devoting a large share of their time to the management of the project.

This Month's "NEWS REEL"



BOULDER DAM TOPPED OUT. Concreting by Six Companies Inc. for U.S. Bureau of Reclamation structure across Colorado River is carried to final crest elevation 729 ft. above lowest point of foundation. Intake towers also have reached their ultimate height. Water is shown backing up against curved face of dam. Notable stage in construction is illustrated in insert (at left) when 3,000,000th cu.yd. of concrete was deposited in dam 18 months after pouring started.



LOW-RENT HOUSING PROJECT nears completion. A group of 957 families will be accommodated in Boulevard Gardens at Woodside, Borough of Queens, New York City, built by Dick-Meyer Corp. and financed by PWA loan of \$3,450,000.



MADAM SECRETARY INSPECTS GOLDEN GATE BRIDGE. Wearing steel-worker's "hard-boiled" hat, Frances Perkins, Secretary of Labor in President Roosevelt's cabinet, discusses working conditions with G. A. McClain, construction superintendent (at left) and F. E. Stanley, riveting foreman on \$35,000,000 structure crossing San Francisco Bay with 4,200-ft. suspension span, world's longest, carried by two 36½-in. diameter cables. In background is 746-ft. steel tower at north end of crossing in Marin County.



FIRST CONDUIT SECTION on Colorado River aqueduct in California is started near Eagle Mountain where Thompson-Starrett Co. sets steel forms with aid of crawler crane which is shown lowering a curved side panel into place. There are 55 mi. of similar open-cut conduit construction on the 241-mi. aqueduct line.

TYGART RIVER DAM at Grafton, W. Va. is started with cofferdam construction by Frederick Snare Corp., contractor, of New York City, under \$6,249,000 contract with U. S. District Engineer office at Pittsburgh. Dam, of straight gravity type, will be of concrete, with height of 235 ft. and crest length of 1,850 ft. Structure financed by \$10,000,000 PWA allotment is first of series in flood control plan for headwaters of Ohio River.



FIRST OF FIVE 500-FT. STEEL SPANS of through-truss type forming part of East Bay crossing of San Francisco-Oakland bridge. Steel erection by Columbia Steel Co. is handled by traveling derrick aided by scaffold bents supporting structure from temporary pile clusters between permanent piers.

FIRST CABLES (left) $2\frac{1}{4}$ in. in diameter, are strung by Columbia Steel Co. to support "catwalk" as preliminary to spinning of main cables between center anchorage and tower W-1 of \$75,000,000 San Francisco-Oakland Bay Bridge. Catwalk cables are anchored to small eyebars, while large eyebars will form anchorage for strands of main $28\frac{3}{4}$ -in. diameter suspension cables.



CATWALK FOR TRIBOROUGH BRIDGE across Hell Gate, East River, New York City, is constructed by American Bridge Co. as preliminary to spinning cables for 1,380-ft. suspension span between steel towers 270 ft. high above pier bases, built by Taylor-Fichter Steel Construction Co. Completed bridge will connect city's boroughs of Queens (Long Island), Manhattan and the Bronx.



WELDED STEEL PLATE FACING on upstream side is construction feature of El Vado dam in New Mexico built for Middle Rio Grande Conservancy District, C. A. Anderson, chief engineer. Dam is 500,000-cu.yd. gravel fill 170 ft. high and 1,200 ft. long on crest. American Bridge Co. installed water-tight steel membrane to prevent leakage and nullify wave action.

CELLULAR COFFERDAM
 A 2,625 ft. long, filled with selected sand and gravel and topped with a 6 in. concrete slab, incloses on three sides a 16-acre construction area in which the Dravo Contracting Co., of Pittsburgh, is building a pair of Ohio River locks at Hogsett, W. Va., 9 mi. below Gallipolis, Ohio, for the Corps of Engineers, U. S. Army. To produce 245,000 cu.yd. of concrete for the lock walls and supplemental structures the contractor has set up inside the lower arm of the cofferdam a semi-automatic batching and mixing plant powered by electric motors and controlled by pushbuttons. Buckets of mixed concrete are hauled from the plant by industrial railway and are handled into the forms by whirler cranes, some of which are new electric machines of exceptionally large size, designed to serve the upper lifts of the high lock walls. To reduce the accident hazard incurred by complying with PWA regulations requiring employment of local labor, largely inexperienced in heavy construction, the contractor carried out on this job a vigorous safety program which has produced gratifying results.

Lock Dimensions—A main lock, 600 ft. long by 110 ft. wide, and an auxiliary lock providing a clear area 360x110 ft., are being built under the present contract, which has a value of \$3,145,791. Work on the dam, awarded to the same contractor at a contract price of \$2,982,618, has been in progress since January. The combined structures, designated Gallipolis Lock and Dam, will raise the river upstream to a normal pool level 26 ft. above the existing normal pool of Ohio River lock and dam No. 27, at Proctorville, Ohio. An unusual feature of the Gallipolis lock design is the use of curved mitre gates for the downstream closure of both locks. In these gates the upstream girders of the horizontal trusses are curved in the shape of a bow-string. When the two leaves of a gate are closed, the upstream girders form a continuous arc across the lock chamber.



CELLULAR COFFERDAM

Assists Construction of Pair of

All the lock walls are inclosed in the cofferdam area. The land wall, with its connecting lower guide wall and upper guide wall, has an overall length of 2,158 ft., made up of: land wall, 855 $\frac{3}{4}$ ft.; lower guide wall, 580 ft.; upper guide wall, 722 $\frac{1}{4}$ ft. The overall length of the continuous concrete structure on the river side of the auxiliary lock is 1,726 ft. This length is made up of: river wall, 638 ft.; lower guard wall, 452 ft.; and upper guard wall, 636 ft. The intermediate wall measures 925 $\frac{1}{4}$ ft. from nose to nose.

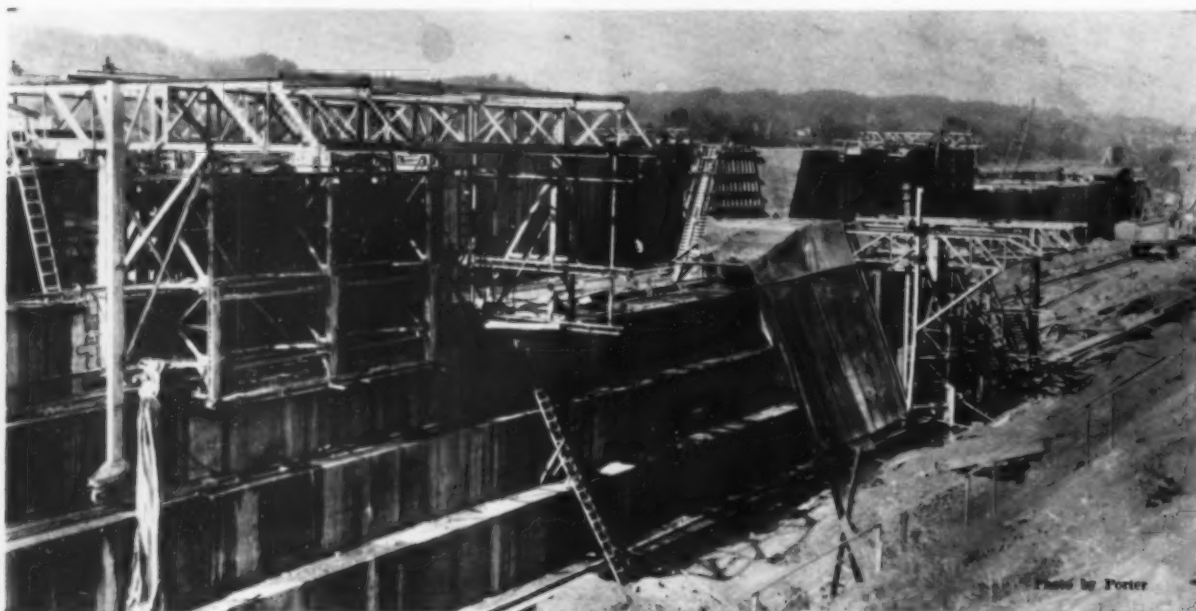
Rock was uncovered at an average elevation of about 496 above sea level

datum. Foundation trenches for the walls and gate sills were excavated to an average depth of 6 or 8 ft. below this level. In some places the excavation had to be carried 14 ft. below the rock surface to obtain a sound foundation. Wall footings extend from foundation rock (at about El. 490) to El. 498, except the footing of the upper guard wall, which rises to El. 498.4 and the footing of the lower guard wall, which rises to El. 497.6. The upper guide wall rests on timber piles cut off at El. 517, 2 ft. above the bottom of the concrete. On the river side this pile foundation

is protected from scour by a steel sheet-pile cutoff wall driven into rock and anchored in the base of the concrete. All the walls rise to a uniform height at El. 556. Width of the footings varies from a maximum of 48 ft. for the widest portions of the land wall to a minimum of 26 ft. for the upper and lower guard walls. The upper guide wall, resting on timber piles, has a base width of 22 ft.

Cofferdam—Specifications required that the cofferdam be constructed of connected circular cells of interlocking steel sheetpiling driven into rock and filled to El. 530, 18 ft. above pool, with a base width equal to the height and with a 6 in. concrete slab surface on top. As actually constructed by the Dravo Contracting Co., with the approval of the U. S. Engineers, the cofferdam consists of a series of cells having curved inside and outside walls of Carnegie steel sheetpiles driven on circular arcs. These cells are made of 36 ft. steel sheetpiling, and the cofferdam has a width of 40 ft.

As built, the cofferdam takes a flood of 20 ft. to El. 532 without movement. When a rise above this level is imminent, two sluice gates in the lower arm of the cofferdam are opened and the



TRAVELING STEEL GANTRIES support wooden forms used in wall construction. Trailer housing on timber framework, attached at forward end to steel gantry, moves ahead with traveler.



PAVED CELLULAR COFFER-DAM more than 2,600 ft. long is constructed with floating plant. Double-deck timber templet (on opposite page) guides setting of piles around cofferdam cell. Mixer boat against coffer wall places 6-in. concrete slab on top of sand and gravel fill.

the land wall of the locks. Prior to the placing of this fill, the offices of the general contractor had to be erected on long piles at a considerable elevation above the original ground surface.

Rock conditions varied at the two ends of the cofferdam area. In the lower half of the job a formation of hard sandstone overlay a stratum of soft shale which had to be removed to uncover sound foundation rock for the lock walls and gate sills. In the upper half of the area the top layer of hard sandstone was not encountered, but a fairly thick stratum of shale covered the foundation rock. Channeling was done by means of four Dravo drilling and broaching machines equipped with Ingersoll-Rand drifters.

Sub-Cofferdam—Before cutting into the toe of the slope to excavate for the foundation of the land wall, the contractor drove immediately behind this wall a cellular sub-cofferdam of steel sheet piles 27 ft. long and installed along the land side of the sub-cofferdam a line of Moretrench wellpoints on 5-ft. centers. Placing of the wellpoints was difficult because of the presence of hard clay, gravel and boulders. To overcome this condition, the contractor developed a hole-puncher, as indicated in an accompanying drawing, which worked satisfactorily. Application has been made for a patent on this device. In installing a wellpoint, the first operation was to jet or drive the hole-puncher to rock. The wellpoint then was placed inside the hole-puncher, and the intervening space was filled with coarse sand. As the final step, the puncher was removed.

INCLOSING 16 ACRES

Ohio River Locks at Gallipolis

construction area is flooded. The contract provides a compensation of \$5,000 to the contractor each time the river overtops the cofferdam. This \$5,000 covers about one-third of the cost of flooding. Water had to be admitted to the cofferdam twice in the spring of 1934, a few hours in advance of overtopping by the river. This spring, the contractor will take care of similar floods in the same way. Under a maximum head at overtopping of about 36 ft., no movement was discernible in the cofferdam. Three American vertical-shaft impeller-type 16-in. well pumps, each driven by a Westinghouse 100 hp. motor, unwater the cofferdam after flooding and keep the bottom dry during construction.

Steam whirler cranes mounted on barges handled the steel piles and steam hammers employed in driving. Two floating timber templets used in setting the steel sheetpiles around the cofferdam pockets were equipped with spud wells for 16x16-in. timber spuds. These spuds proved valuable for leveling up the templets.

Excavation—A subcontract to remove excavation from the cofferdam area was awarded by the Dravo Contracting Co. to the Grant Contracting Co., a

subsidiary of the American Aggregates Corp. Common excavation amounted to about 550,000 cu. yd. and rock excavation to about 35,000 cu. yd. The general contractor channeled, blasted and mucked the rock, which was disposed of by the subcontractor. After a brief and unsatisfactory attempt to adapt a long belt conveyor from a gravel plant to handling excavated earth, the Grant Contracting Co. hauled

all the material up a steep grade for disposal with three standard-gage dinkeys, pulling 30-yd. air-dump cars. Five dump trucks were utilized for shorter hauls. To load the spoil and rehandle it, when necessary, at the dump, the subcontractor operated two 2-yd. diesel draglines, one smaller gasoline dragline, and one diesel shovel. Much of the spoil was used to raise the level of the Government reservation adjacent to



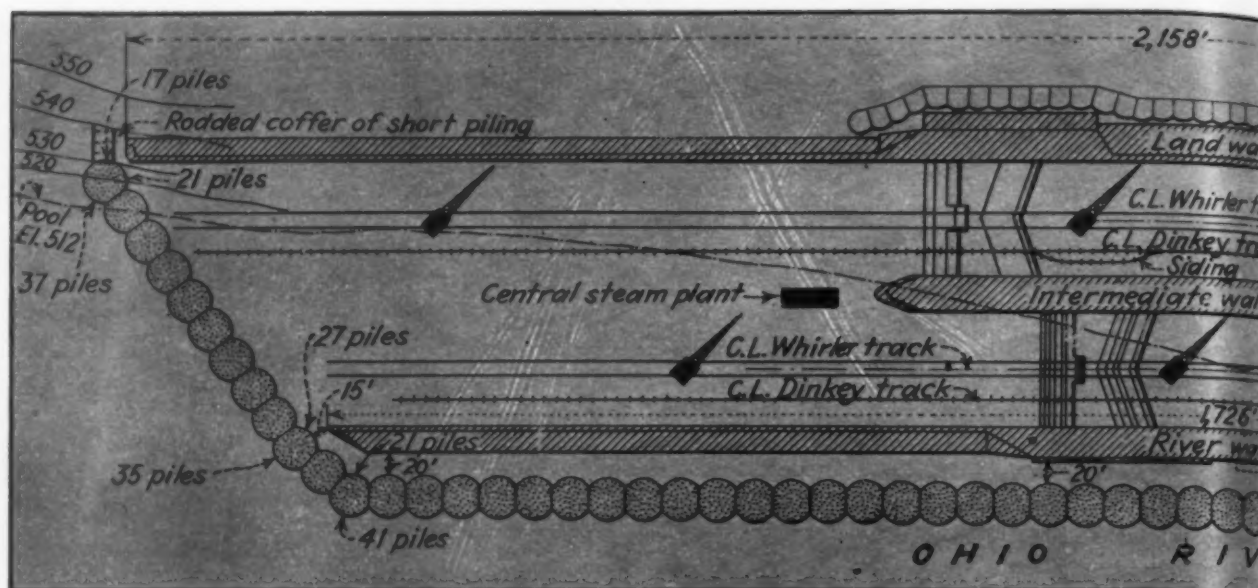
DOWNSTREAM ARM of cofferdam approaches closure as floating rigs build successive cells from river bank, setting sheetpiles around templets anchored in position by timber spuds.

Compressed air for various operations is supplied by a stationary compressor plant erected on the bank near the downstream arm of the coffer. This plant contains two Ingersoll-Rand compressors of 550- and 880-cu. ft.-per minute capacity, driven by G.E. 100 hp. and 150-h.p. motors respectively.

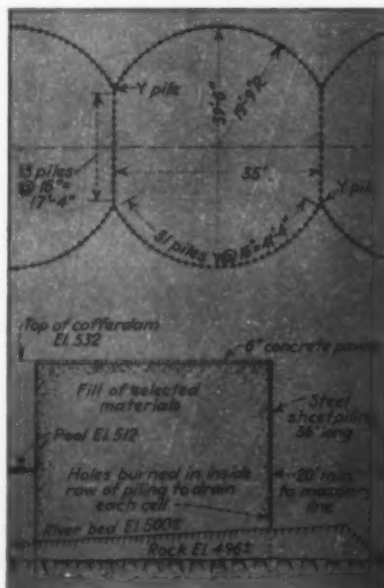
An electric whirler crane mounted on the cofferdam handles the sand and two sizes of gravel with a 2-yd. clam-shell bucket out of barges into three 30-yd. compartments of a four-compartment steel bin. One of the compartments is not used on this project. Bulk cement is pumped from barges



DRILLING AND BROACHING MACHINE makes channeling cut for lock-wall foundation in rock.



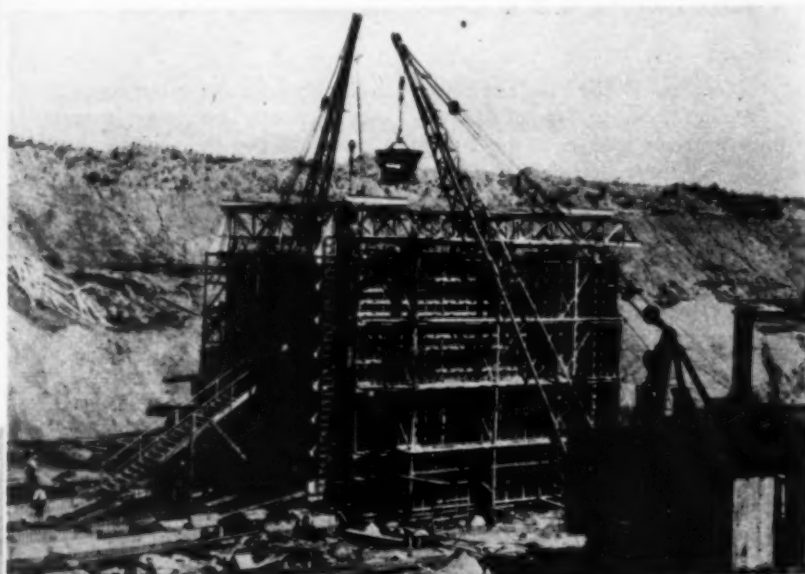
LAYOUT OF CONSTRUCTION PLANT at Gallipolis Locks. Cellular cofferdam incloses 16-acre area in which contractor excavates rock foundations for lock walls and gate sills. Whirler cranes in hole



TYPICAL COFFERDAM CELL in plan and sectional elevation. Sheet-piles are driven into rock, and cofferdam is paved with 6-in. concrete slab.

40 sec. In actual practice, it is seldom that an average of 3 min. per batch, or 20 batches per hour, is exceeded for the reason that on lock work considerable delay is encountered in placing concrete around recesses and embedded steel. These delays are especially noticeable at the tops of the walls, which are 60 ft. high.

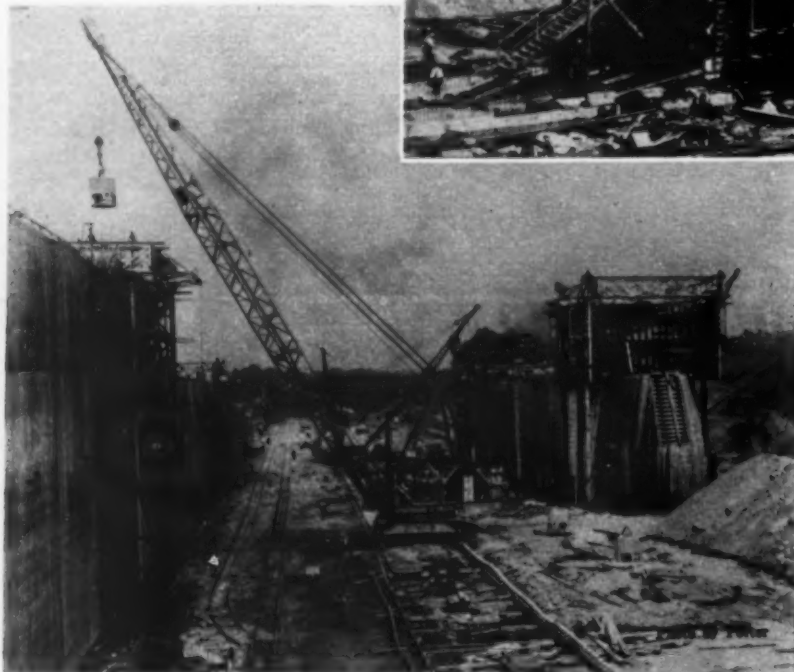
Concrete is hauled from the plant



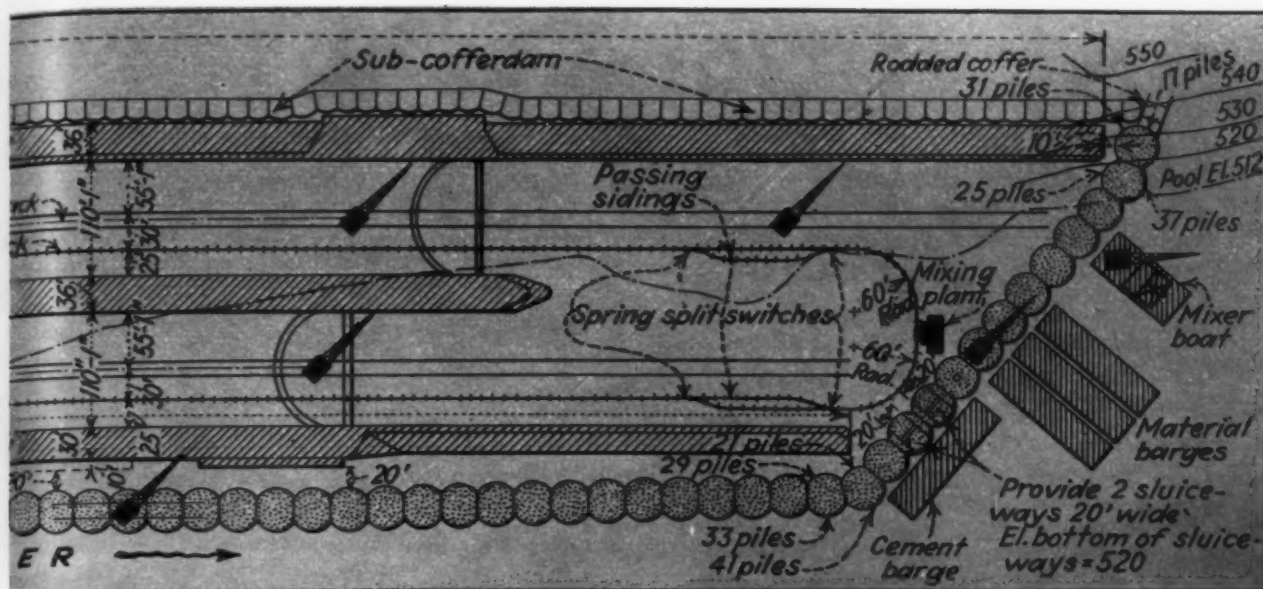
GANTRY-MOUNTED WOODEN FORMS build up two 18-ft. concrete lifts at start of construction above footing of intermediate wall. Note stairway for workmen.

by two Vulcan gasoline dinkeys operating on 36-in. gage track. Each locomotive hauls two Dravo 2-yd. bottom-dump buckets on flat cars. Long-boom whirler cranes raise the buckets of concrete into the forms. Total concrete requirements for lock walls, sills and appurtenant structures are estimated to be about 245,000 cu.yd.

Whirler Cranes—Two unusually large electric whirler cranes were built by the contractor to place concrete in the lock walls, which rise 60 ft. above the general level of cofferdam excavation. These machines, equipped with



115-FT. BOOM of electrically driven whirler crane traveling on 16-ft. 10-in.-gage track places concrete in lock wall 60 ft. high. Two whirlers of this size handle upper lifts of concrete.

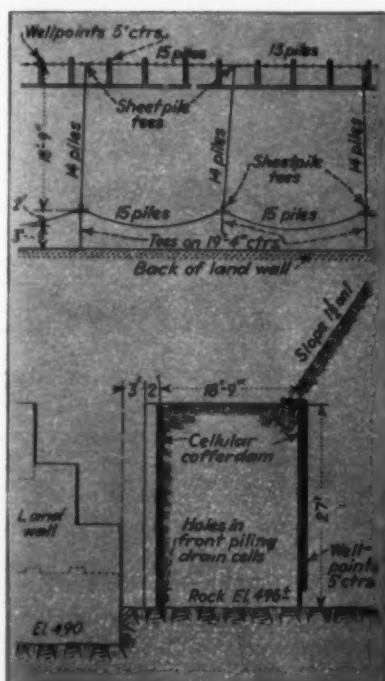


Steel gantry forms were used in building up the river wall and middle wall in three lifts ranging from 18 to 20 ft. in height. In the construction of the land wall, the first lift above the footing, 12½ ft. high, was cast in sectional timber form panels. On top of this lift, steel gantry forms were employed to build three lifts ranging from 10 to 18 ft. in height. Six sets of timber forms were utilized for the entire concreting of the upper guard wall.

Winter Concreting—Specifications provide that heated aggregates and water must be used for concrete mixtures placed in cold weather. They further require that concrete when placed must have a temperature of not less than 50 deg. nor more than 100 deg. F. Adequate protection meeting the approval of the contracting officer must be provided, and the air in contact with the concrete must be maintained at a temperature between 50 deg. and 70 deg. F., for a minimum of 5 days following placement of the concrete. During this period the concrete must be kept damp.

Live steam was selected by the con-

handle buckets of concrete delivered by narrow-gage railway from mixing plant. Cellular sub-cofferdam behind land wall retains steep earth bank during foundation excavation.



cover all parts of the widest portion of the river wall.

Seven additional Dravo whirlers in operation on the project have booms 85 ft. or 95 ft. in length. The electric whirler feeding the bins of the concrete-mixing plant has a 100-hp. hoist engine and a 40-hp. swing engine; three other electrically powered cranes operated in the hole have 100-hp. and



CELLULAR SUB-COFFERDAM
and well-point drainage system pre-
vent slides in steep bank behind
land wall.

PROGRESSIVE STAGES IN LOCK-WALL CONSTRUCTION. At left, whirlers are excavating land-wall foundations in front of sub-cofferdam. In left foreground is completed footing of middle wall. Gantry forms for three lifts of river wall are in evidence at right. Timber tower on top of bank supports power lines which cross river to job at this point.

30-hp. motors for these motions. Two steam whirlers in the hole and one on the river wall of the cofferdam have engines of about the same horsepower. The seven whirlers are mounted on flanged-wheel trucks of 13-ft. 10-in. gage.

Wall Forms—Lock walls were built up in successive lifts above the concrete footings with wood forms supported by steel gantry travelers or with sectional wood panel forms handled by the whirler cranes. The contractor used seven Blaw-Knox steel gantries which were

tractor as the most effective means of heating aggregates and as the most economical agent to perform the dual function of warming the atmosphere surrounding the concrete and, at the same time, keeping the surface of the concrete damp. Two 100-hp. boilers on the mixer boat supplied steam for heating aggregates in the barges and for curing the blocks of concrete in the lower portion of the land wall. A steam plant consisting of three 80-hp. vertical fire-tube boilers was set up in a central location inside the cofferdam to supply

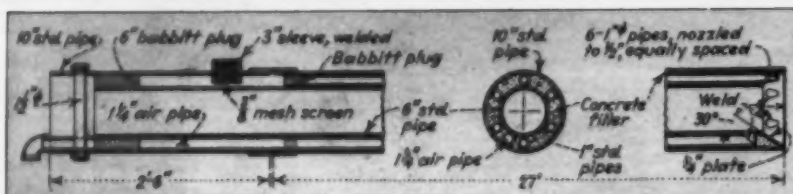
HOLE-PUNCHER equipped with water jets and air jet excavates opening in conglomerate material for installation of well point.



ONE SLUICE GATE OPENED to flood cofferdam prior to overtopping in spring of 1934.



IN CHARGE OF OPERATIONS. (Left to right) J. B. Edgerton, senior inspector for U. S. Engineers; C. W. Granacher, contractor's field engineer; and Edward ("Red") Weiher, superintendent for Dravo Contracting Co.



TUBULAR EXCAVATOR designed to punch holes for well points consists of double-walled pipe with single compressed-air conduit and six water-jet conduits incased in concrete fill between inner and outer walls of tube.

THRASHING OUT A PROBLEM on the job. B. N. Parker (left), assistant superintendent, listens to B. H. Ellis, master mechanic, while Edward ("Red") Weiher, superintendent, thoughtfully chews a splinter before casting his vote.

steam through 4-in.-diameter mains laid in wood box conduits. To the mains were connected risers of 2-in. or 1 1/2-in. rubber hose which delivered the steam to perforated pipes drilled with 1/8-in. or 3/32-in. holes at intervals of about 3 ft. The steam plant supplied steam for curing a maximum of nine wall blocks at one time.

Forms remained in place a minimum of 72 hr. after concrete had been poured. During this period tarpaulins were spread over the top of the concrete block, and perforated pipes were

laid under the tarpaulins. To protect the concrete after the forms had moved ahead, the contractor used a combination timber-and-canvas housing attached to the steel form gantry. This housing amounted to a set of timber trusses fastened at the front to the steel gantry and supported at the rear upon skids which traveled on wood planks as the gantry moved ahead. The roof of the housing consisted of 7/8-in. sheathing covered with tar paper, and the sides were inclosed by canvas tarpaulins supported on timber framing. Concrete placed in sectional wood panel forms was protected by canvas tarpaulins after the forms have been stripped.

Safety Program—Conservation of

employees' lives and health has been a major consideration of The Dravo Contracting Co. for years. With the employment of inexperienced local labor on PWA projects, in compliance with the regulation giving preference to local residents, the accident hazard increased greatly. In March, 1934, the efforts of The Dravo Contracting Co. crystallized in definite form with the appointment of a safety director having full authority to control accident-prevention measures and the employment of men on the company's various contracts. Under the director's leadership, the company instituted a strong safety campaign which has produced definite results in the reduction of accidents, saving of men's lives, and lower-

ing of compensation and accident charges. This program will be described fully in an article to appear in an early issue.

Progress—Predicted and actual progress in the construction of the Gallipolis Locks are in close accord. Operations at the site began on Oct. 23, 1933. It is expected that the contract will be completed by August 1, 1935. Up to midnight of March 2, the contractor had placed 196,852 cu.yd. of concrete.

Administration—For the Corps of Engineers, U. S. Army, the district office, Huntington, W. Va. has been in charge of design and construction of the Gallipolis locks. Major F. W. Herman was district engineer until August, 1934, when he was succeeded by Major John F. Conklin. At the site, J. B. Edgerton was senior inspector in charge of the work until the arrival of G. P. Fleetwood, resident engineer, on January 7, 1935.

LAST TOWER ERECTED

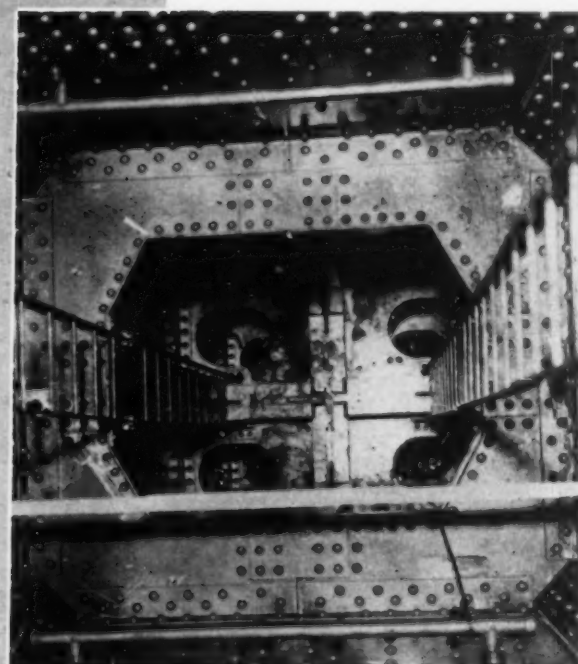
for West Crossing of Bay Bridge

RISING to a height of approximately 500 ft. above water level in San Francisco Bay, tower W-5 is the last of four similar structures on which steel erection has been completed to support the twin 2,310-ft. main suspension spans and 1,160-ft. side spans forming the West Bay crossing of the 8-mi. long San Francisco-Oakland Bay bridge. The topping out of the final tall tower of the \$75,000,000 bridge paves the way for the building of the catwalks and the spin-

of the U. S. Steel Corporation, which has the contract for fabricating and erecting the tall towers, made use of a pair of hammerhead cranes for handling the heavy steel members. Each crane consists of a vertical post 108 ft. long and a 53-ft. horizontal girder along which the hoisting sheaves are moved in and out on a carriage. The lower 40 ft. of the post is always inside the cellular tower leg to assure stability without the use of guys. As each erection lift is 50 ft. the crane posts are



LOOKING UP into cellular leg of tall steel tower of San Francisco-Oakland Bay bridge, showing ladders for use of workmen.



LOOKING DOWN into hollow leg of tower, showing steel segments divided into cells with walls 1 1/8 in. thick.

ning of the 28 3/4-in. diameter cables which will carry the suspension bridge structure between San Francisco and Yerba Buena Island, through which a 58x76-ft. vehicular tunnel extends to make a connection with the East Bay bridge crossing to Oakland.

The towers are cellular structures of riveted steel with twin legs stiffened by diagonal cross-bracing, as shown in the accompanying illustration. Each tower leg has a maximum section, at its base, of 17x35 ft., and rests upon a base-plate of steel 4 in. thick which in turn is seated upon the top of a concrete pier. The towers are supported by caisson piers of concrete and steel which were floated to place, grounded in deep water and excavated to firm rock foundation by dredging through a group of vertical cylindrical wells.

The Columbia Steel Co., a subsidiary



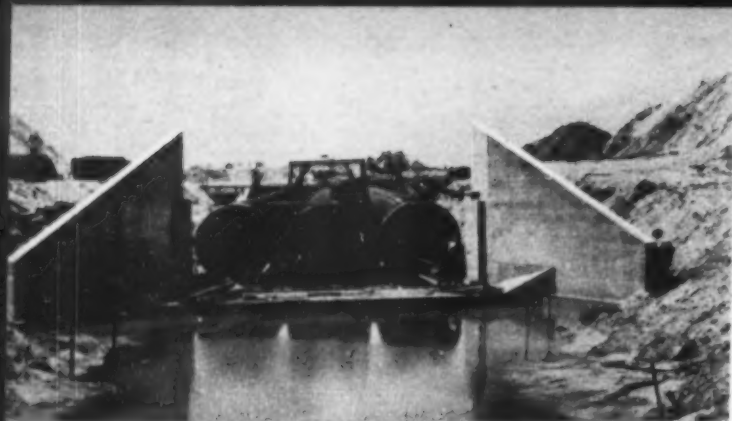
HAMMERHEAD CRANES, supported by vertical posts extending into tower legs, erected steel for tall cellular legs of structure that will carry suspension cables of bridge.

practically enveloped by the steel structure of the tower leg before they are "jumped" to the next operating level. At times the hammerhead cranes were called upon to handle loads of 80 tons and in these cases counterweights were placed on the rear ends of the crane arms. Without counterweights, 50 to 60-ton loads were moved.

For the West Bay crossing between San Francisco and Yerba Buena Island the suspension bridge structure will carry a double-deck roadway. The accompanying view shows the location of these roadways where horizontal steel members, spaced 26 ft. apart, join the two legs of the tower.

The San Francisco-Oakland bridge is being built by the California Toll Bridge Authority under the direction of C. H. Purcell, chief engineer of the California Dept. of Public Works.

Pioneer Crews Erect for Levee Project



BUILDING 3,395 ft. of 10-ft. internal-diameter sectional-plate metal culverts through levees now under construction along the south shore of Lake Okeechobee (at the northern end of the Florida Everglades) involves difficult excavation, transportation and erection problems. Vast local swamps and the isolation of the projects contribute to these difficulties.

Construction of 66 mi. of levees then under way was described in *Construction Methods*, Aug. 1934, pp. 34-37. Thirteen sets of from one to six culverts included in the project will provide inlets and outlets from the lake, depending on the water level of the latter and on whether it is desired to drain or irrigate adjacent low lands back of the levees.

Local conditions were outlined in the previous article. In all cases it was necessary to erect the culverts before the levees at the culvert sites could be built. This fact required the culvert contractors to do much of the pioneering in getting to their jobs and in organizing

TRIPLE-UNIT 120-IN. MULTI-PLATE CULVERT is designed to pass water in either direction through Lake Okeechobee levee. Headwall connecting wing walls remains to be constructed.

ROUNDED FOUNDATION (right) for invert of culvert pipe is shaped by hand.



transportation to bring in materials.

Culvert Excavation—Excavation for the culverts was handled in cofferdams with light crawler-mounted shovels and

cranes. The excavators had to be brought in across swamps as much as 4 mi. from the nearest highway. Various expedients were used to get the machines to the job, small barges, floats and similar methods being employed.

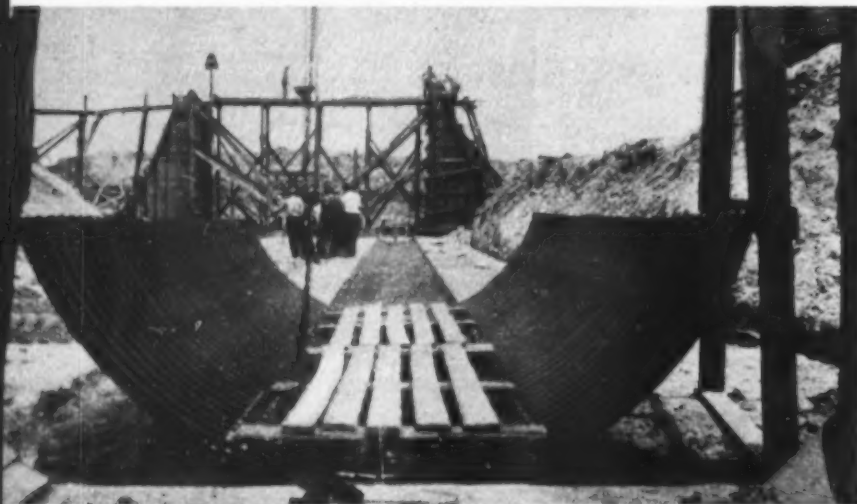
Comparatively little difficulty was experienced in keeping most of the cofferdams dry. The bed of the practically continuous Everglades swamp adjacent to the lake, is usually a soft muck, but under this layer is generally impervious material that makes a tight cofferdam seal.

Dipping Culvert Plates—Sectional plates for the culverts were shipped from the fabricating plants punched and bent to exact shape. Dipping in special hot bituminous coating was done in the field. Delivery of the plates from the factory was largely by water, barges being used to reach a dipping plant set about midway of the job. The largest sectional plate weighed 463 lb. Differential blocks swung from an overhead track on a trestle at the dipping plant

eliminated much hand work and enabled a small crew to dip the heavy plates rapidly.

Specifications for dipping were necessarily rigid because of the hard conditions to which the culverts will be subjected in service. The temperature specification was met satisfactorily by setting up an insulated semi-portable tank heated by gas burners. With this outfit there was no difficulty in maintaining the dipping compound at the required temperature of 430 deg. F. As the coating dried fast there was no need for storing the dipped plates.

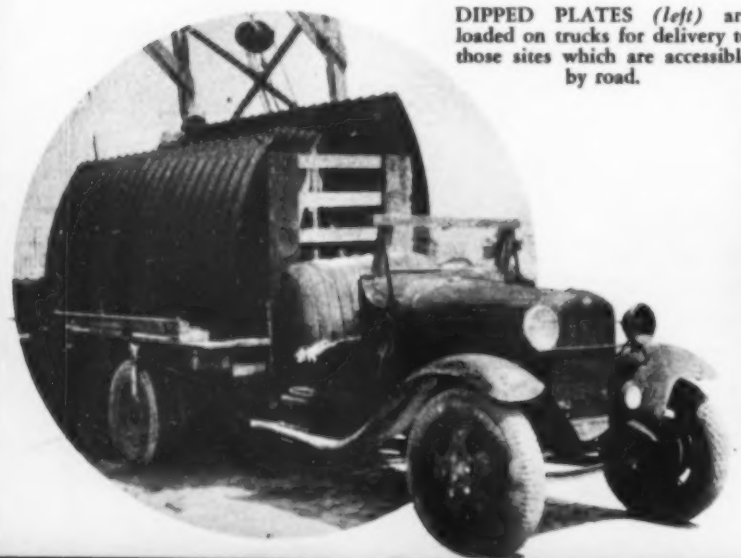
Delivery to Site—Transportation of the dipped plates from the plant to the several jobs was handled according to the possibilities of reaching the sites. To a limited extent delivery could be made by motor truck. For the remainder of the jobs barges were used to move the plates to points near the culvert sites. From the unloading points the plates were shifted to the edge of the excavation on small flat-wheel cars



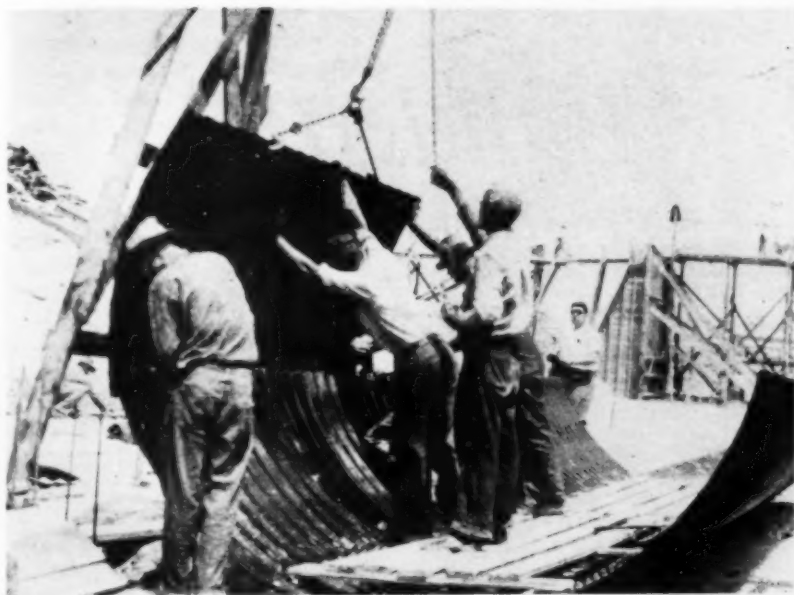
PIPE INVERT is laid in advance of haunch sections, which are erected to equal height on two sides to maintain balanced load on invert.

DIPPED PLATES (left) are loaded on trucks for delivery to those sites which are accessible by road.

CHAIN HOIST ON GANTRY GALLOWS FRAME (below) raises plate sections for upper half of culvert pipe.



Multi-Plate Culverts at Lake Okeechobee



SIDE PLATE of culvert pipe is hoisted and bolted in place. Similar plate on opposite side will be erected next.

operating on planks laid on the ground. From these cars the plates were lowered into the holes by hand on plank inclines. No difficulty was experienced in protecting the coating from damage during handling.

Pipe Erection—Shaping of the bottom of the excavation for the invert section of culvert pipe was done by hand. Assembly of the invert sections was then carried ahead of the rest of the barrel. The sides were bolted to the invert section up to the springing line of the arch. By erecting the two sides to the same height as the work advanced the load on the invert was balanced and shifting avoided.

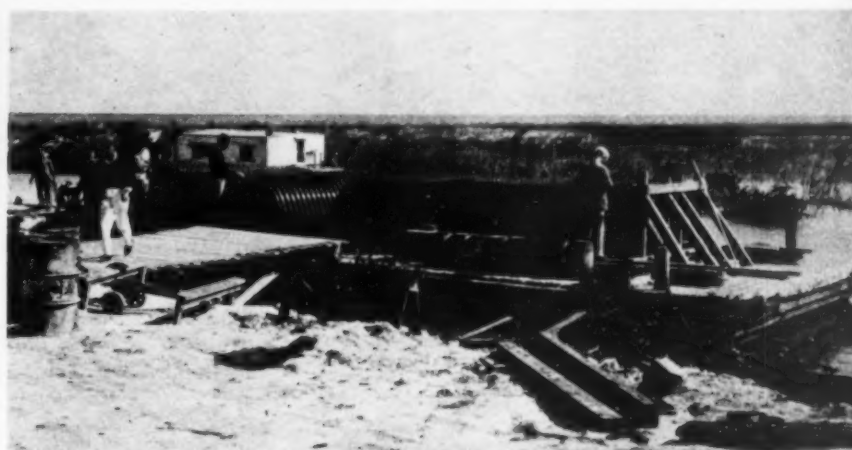
With the sides set somewhat ahead, erection of the arch was brought along with a balanced load on the haunches. The several steps in pipe erection were

so handled that a fair-sized crew could work continuously without interference. Handling of the plates was simplified by the use of a light hand hoist on a timber gantry which the erection crew readily shifted by hand as required.

Administration—Plans for the Lake Okeechobee flood control works were prepared by the Corps of Engineers, U. S. Army, and are being executed under the supervision of that organization. General Edward M. Markham is chief of engineers, and Lieut. Col. B. C. Dunn is engineer of the district, with headquarters at Jacksonville, under which the project is conducted. Lieut. P. A. Feringa is military assistant in that office. Caraway Nelson is engineer in charge of the project, with Raymond C. Baird, C. C. Schröntz and Perry M. Teeple as associate engineers. Lieut. R. Selee is



AT DIPPING PLANT, overhead I-beam trolley hoist handles heavy plate sections, weighing up to 463 lb. each.



BARGES deliver plates to dipping plant and transport most of coated plates from plant to unloading points near culvert sites.

resident engineer on the project, having associated with him E. W. Digges, assistant engineer and Lieut. W. H. Mills, of the Corps of Engineers.

George B. Hills, of Hills & Youngberg, consulting engineers for the Lake Okeechobee Flood Control District, has been associated with the project in this capacity since its inception.

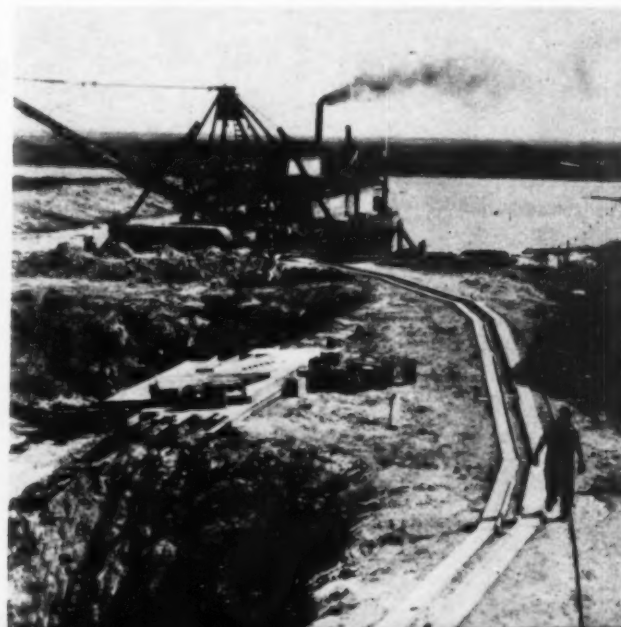
Of the 2,400.5 ft. of 10-ft. sectional pipe let to the date these notes were prepared, 2,130.5 ft. were fabricated

and assembled under subcontracts by the Tri-State Culvert Mfg. Co., of Memphis, Tenn., using Toncan iron sectional plates. The remainder was similarly supplied by the Dixie Metal & Culvert Co., of Jacksonville, Fla., using Armco iron. Field work has been handled under contract by C. Y. Thomason, Greenwood, S. C., Wannamaker & Well, Inc., Orangeburg, S. C., and the North American Construction Co., Jacksonville, Fla.

GREASED INCLINE (*below*) is used to lower pipe sections from top of bank into hole at culvert site.



PLANK TRACK (*right*) for hand cars which transport plate sections from barge unloading point to culvert site.



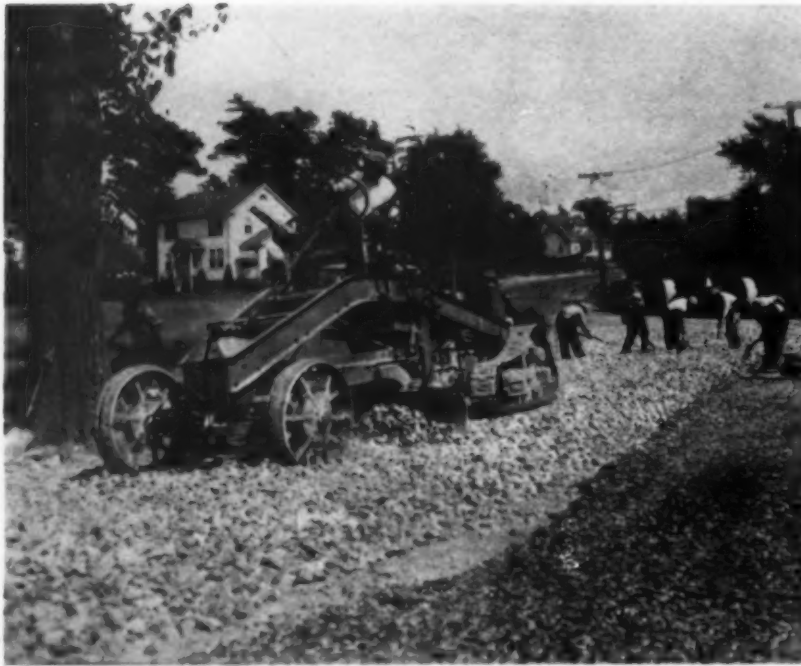
Step-by-Step Field Methods

BITUMINOUS MACADAM

as Massachusetts Builds It

FOR EXCELLENCE of bituminous macadam roads Massachusetts has long been recognized as outstanding among the states. Years of experience with this type of construction have enabled the Commonwealth's Department of Public Works, under the long-term administration of Arthur W. Dean, its chief engineer, to develop a discrimination in the selection of materials and a technique in their application that insure a consistently high-quality pavement, in which are combined the advantages of durability, smooth riding and safety from traffic accidents caused by skidding of motor vehicles. Three major factors contribute to the results obtained: (1) Adequate design; (2) selection of proper materials; (3) painstaking care and refinement in the details of construction, reinforced by a policy of rigid inspection.

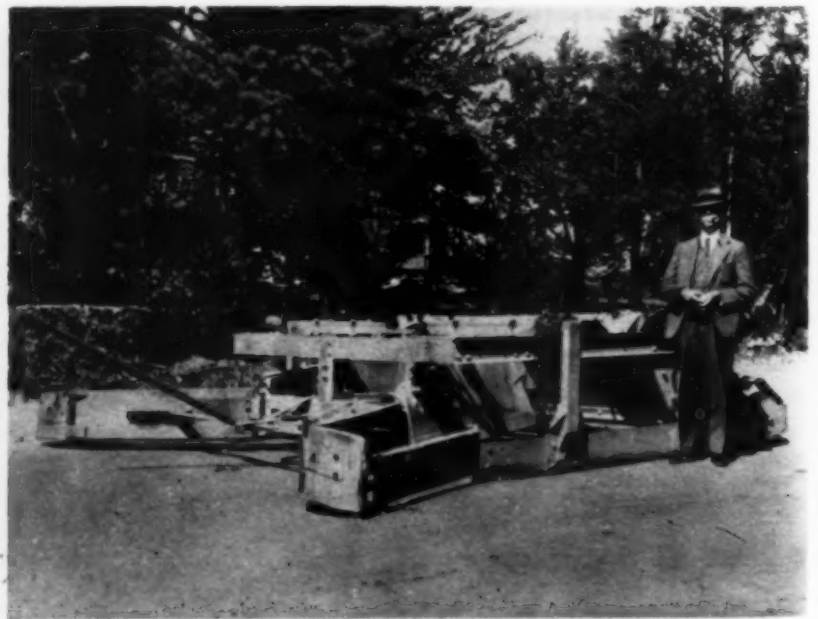
Sub-Base—Written large in the Massachusetts creed for bituminous macadam construction is the tenet of adequate



3 BLADE GRADER, self-powered, assists hand spreading of stone for base course at unusually wide street intersection. For ordinary road widths, however, spreader boxes are employed.

drainage and stable, uniform support for the pavement structure. Good bituminous construction, it is maintained, must begin at the bottom, and so, the first element that the specifications demand is a sub-base, either of gravel or of gravel and stone filling, of a thickness varying according to subgrade conditions, but usually 12 in. deep for the 7-in. thickness of pavement proper generally specified and, for the purpose of these notes and illustrations, exemplified by a bituminous macadam project with a paved width of 24 ft., in the town of Dedham, executed by the Michael McDonough Co. of Malden, a contractor of long experience in this type of construction.

Gravel for the sub-base must be of hard, durable stone (with no piece having a dimension greater than 6 in.) and coarse sand, uniformly graded and free from loam and clay. Stone filling for a 12-in. sub-base may be of ledge or field stones not greater than 12 in. in longest dimension nor less than 1½ in. in



1 & 2 MECHANICAL SPREADERS of two types are designed for attachment to rear ends of motor trucks from which crushed stone is dumped and distributed in courses of desired depth. At left, is simple box type of spreader and, at right, more elaborate machine with adjustable diagonal blades.

shortest dimension, with about 50 per cent of the material 6-in. stone. For the gravel sub-base (when more than 8 in. thick) the material is spread in two or more layers and consolidated by a 12-ton roller until a firm, even surface is obtained to support the broken stone base course of the pavement proper which, in the following notes, will be considered to have the 7-in. thickness common in Massachusetts for bituminous macadam construction.

Broken Stone Base—Upon the prepared gravel sub-base is spread either by hand or, usually, by mechanical devices attached to the rear ends of motor trucks delivering the material, a broken stone base compacted by a 12-ton roller to a thickness of $4\frac{1}{2}$ in. Material for this course may be either entirely of No. 1 stone (passing $2\frac{3}{4}$ in. ring and retained on $1\frac{1}{4}$ -in. ring) or a mixture of No. 1 stone with not more than 40



4 STONE BASE COURSE, $4\frac{1}{2}$ in. thick, is brought to correct surface profile by hand raking and forking prior to binding with stone dust or sand and compaction with 12-ton roller.

After it has been carefully shaped, the base course stone is thoroughly bound with either clean sand or with stone dust broomed in and rolled to fill the voids in the stone and limit the depth of penetration of the asphalt binder subsequently applied to the $2\frac{1}{2}$ -in. top or wearing course of the pavement. The sand or stone dust binder, amounting approximately to 25 per cent of the volume of the rolled stone base, is allowed to come up to a point just below the top of the broken stone, but is not permitted to cover the stone surface. Rolling with a 12-ton, three-wheeled machine is begun at the sides of the road and continued in longitudinal paths toward the center, with an overlap on each trip of one-half the width of the rear wheel of the roller. Rolling is thorough, until the stone pieces become firmly interlocked into a solid, unyielding base.



5 FOR BINDING the stone of the base course and limiting the penetration of asphalt, stone dust or sand is broomed into the voids and allowed to come up to a point just below—not over—the surface.



6 A 12-TON ROLLER compacts the base course, both before and after stone dust or sand binder has been broomed into the voids, into a solidly interlocked, unyielding mass.

per cent of No. 2 stone (passing $1\frac{1}{4}$ -in. ring and retained on $\frac{3}{4}$ -in. ring). As to its physical characteristics, base-course stone must have a percentage of wear of not more than 4 (French coefficient of wear of not less than 10) and a toughness of not less than 8.

Before the base course stone is spread the specifications make definite provisions for its support at the sides by requiring the road shoulders first to be built of sufficient height to hold the stone in place and to permit rolling for at least 12 in. in width simultaneously with the rolling of the base course. Particular emphasis is placed upon bringing the rolled surface of the base course accurately to the true cross-section of the highway.



7 TOP COURSE STONE is of No. 1 size ($1\frac{1}{4}$ to $2\frac{3}{4}$ in.). Laborers with hand forks are distributing material along joint to bring rolled surface flush with asphalt-penetrated strip of pavement, at left, previously completed.

Surface Course—Upon the $4\frac{1}{2}$ -in. base course, prepared as described above, a broken stone top course, $2\frac{1}{2}$ -in. thick after rolling is placed. For this course a tougher, harder stone than that for the base is demanded. Its percentage of wear must not exceed 3 (French coefficient of wear of not less than 14) and its toughness must be at least 12, embodying the qualities of a sound, hard traprock. The top course consists entirely of the larger size (No. 1— $1\frac{1}{4}$ to $2\frac{3}{4}$ in.) stone in order to produce the stable, long-wearing, rough-textured, anti-skid surface which is a marked characteristic of Massachusetts standards for bituminous macadam. After accurate shaping to true profile and compaction with a 12-ton roller



8 PRESSURE DISTRIBUTOR, on pneumatic-tired truck chassis, sprays hot asphalt on 2½-in. thick wearing course at rate of 2 gal. per square yard for main application and later, after blotting with pea stone, at rate of ⅜ gal. per square yard for seal coat.

the surface course is ready for the final operation of asphalt penetration.

The accuracy of the surface profile of the rolled stone is a point that receives much emphasis in the inspection of all bituminous macadam construction in the Bay State. Napoleon's famous dictum that "an army travels on its belly" might be applied literally, rather than figuratively, to the Department of Public Works' army of engineer inspectors who spend a considerable part of their time prone, sighting along the tops of the courses of broken stone in order to detect the slightest depressions or humps and have them filled or flattened precisely to specified grade. A condition of acceptance of completed pavement is that a 10-ft. straight-edge shall disclose no irregularities greater than ⅜ in.

Bituminous Penetration—For penetrating 2½-in. surface course hot asphalt at the rate of 2 gal. per sq.yd. is sprayed upon the surface by pressure distributors. Immediately after this application the asphalt is blotted with

just enough pea stone (¾ to ¼ in. in size) to prevent the bituminous material from sticking to the wheels of the 12-ton roller which consolidates the surface. Then, after a thorough sweeping to remove all loose material and dust, a final seal coat of ⅜ gal. of asphalt per square yard is applied im-

mediately covered with pea stone and rolled again to produce the finished surface. On sections of road where heavy grades occur and it is desired to produce a surface rougher than ordinary to insure adequate traction in wet weather, the final seal coat application is sometimes omitted, but in these cases

the penetration application is slightly heavier.

Asphalt for bituminous macadam penetration in Massachusetts has a specified penetration of from 85 to 100 for ordinary warm weather conditions, but if applied between Oct. 1 and April 30 a penetration of 100-120 is required. At the time of application the temperature of the asphalt must be between 300 and 350 deg. F. Spraying is done by a pressure distributor equipped with pneumatic tires and capable of covering a width of at least 15 ft. at a pressure of from 40 to 60 lb. per square inch. Great care is exercised in the application of the asphaltic binder to prevent an overlap between adjacent sprayed strips which would create a "fat" streak in the finished surface.

The illustrations herewith (on a 24-ft. wide road in the town of Dedham, southwest of Boston) picture the successive stages in the construction of bituminous macadam roads according to standards of the Massachusetts Department of Public Works.

9 SURFACE of wearing course (below) after receiving penetration treatment of hot asphalt at rate of 2 gal. per square yard.



10 PEA STONE blotting cover and seal coat have been applied to complete the wearing surface, which has not yet been used by traffic.



11 THE FINISHED SURFACE, after traffic has removed the excess pea stone covering. This view illustrates the rough-textured, anti-skid surface, with the wear taken by the large stone of the top course, which is characteristic of Massachusetts bituminous macadam.

JOB ODDITIES

*A Monthly Page of
Unusual Features of Construction*



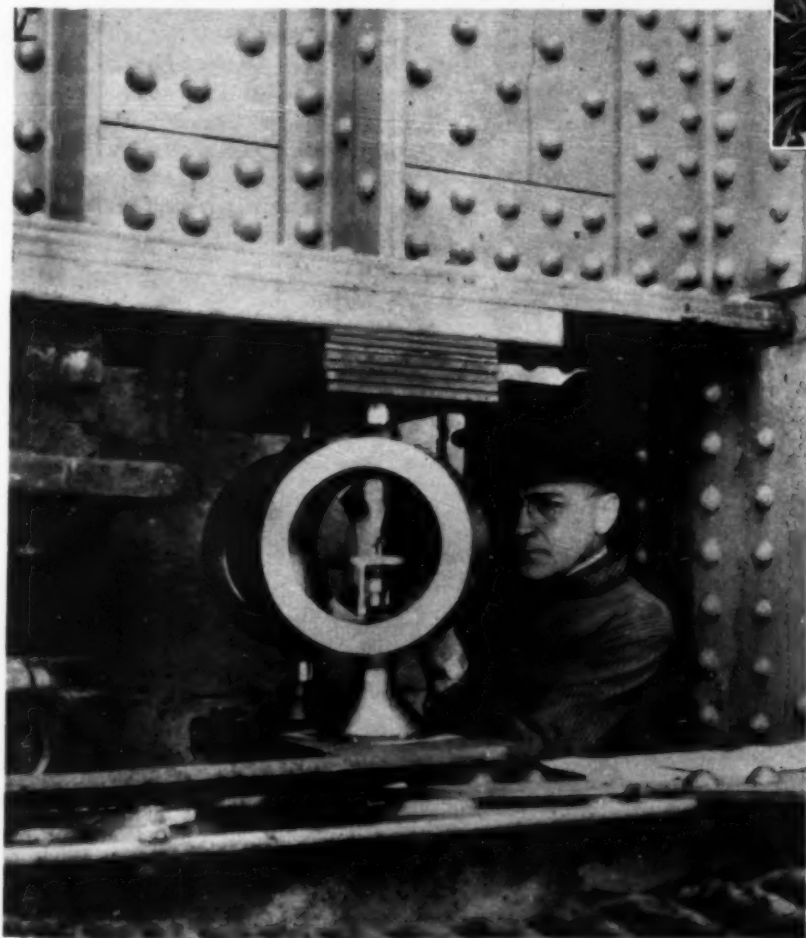
PROTOTYPE OF CITY FLATS. Replica of structure built at Taos by Pueblo Indians before discovery of America is feature at California Pacific International Exposition in San Diego.



INTRICATE CASTING. Dredge cutter head of alloy steel 86 in. in diameter and 68 in. long, with weight of 9,424 lb., is produced at foundry of Link-Belt Co. for big dredge of Kling Bros. Engineering Works, Chicago, for use on government job of river deepening in region of New Orleans.



DISCARDED TIRE BEADS stop settlement and slippage of highway fill over bog on Ohio state route No. 93 south of Akron.—*Photograph from PROF. F. H. ENO, Ohio State University.*



BRIDGE REACTION WEIGHED. Elastic loop, or proving ring, with capacity of 200,000 lb., indicates load by means of deflection readings. View shows equipment carrying one corner of three-span continuous truss bridge over Cape Cod Canal at Bourne, Mass.



LOFTY PERCH of contractor's field office eventually is brought to earth by building up fill to meet floor joists. Dravo Contracting Co., of Pittsburgh, erects job office on long piles at Gallipolis locks on Ohio River at Hogsett, W. Va., in anticipation of raising general ground level of Government reservation adjoining locks with spoil from excavation inside cofferdam.

Clearing Crews Drain Swamps

at Wheeler Dam



TWO CRAWLER DRAGLINES dig portion of 4,300-ft. ditch draining 200-acre swamp in reservoir area to facilitate clearing work.

CLEARANCE OPERATIONS in the reservoir area above Wheeler Dam, TVA's construction project 15½ mi. upstream from Wilson Dam on the Tennessee River, are more than a matter of going in with axes and felling trees. Drainage operations not only have been found helpful, but have materially reduced the cost of this part of the Wheeler project.

For many miles above the dam the terrain along the river is low and level. Annual floods on the Tennessee for generations have overflowed the banks along this part of the river. Decrease in velocity resulting from overflow has caused unusual deposition along the immediate river banks, with the result that in many places the banks of the river are higher than the surrounding bottom lands. After floods or frequent torrential rains, these tracts remain under water, forming numerous sloughs, some full of clear water, others thickly wooded, containing about 2 ft. of water.

To clear such areas at reasonable cost, it is necessary to drain them. In a few instances dynamite was used to blast channels through intervening dikes, but for the most part other drainage methods have been employed.

Thus far eleven such areas have been drained or are undergoing treatment, with an estimated saving of \$36,522, in the clearing of 1,077 acres. On one job, Beaver Dam Lake was lowered 3

ft.; on another, Swan Lake was lowered 4½ ft. In each case, swampland surrounding these bodies of water was drained and clearance facilitated.

Blackwell Swamp, 1 mi. east of the Madison-Limestone county line, affords a typical example of how a drainage job is handled. This swamp was surveyed by the Authority's Engineering Service Division and a report was made to the Reservoir Clearance Division on elevations and character of drainage necessary to draw the water from the lake in Blackwell Swamp. The report stated the approximate number of acres affected. Based on these data, the Reservoir Clearance Division set up an estimate of the cost of the job and an estimate of possible savings that would result from draining the area.

Blackwell Swamp proved to be 199.6 acres in area, and its draining entailed the use of two dragline ditch diggers. A ditch 4,300 ft. long was necessary to connect the swamp and the Tennessee. Part of this ditch, on which the draglines were used, was 38 ft. across the top and 15.3 ft. deep. About 16,000 yd. of earth was excavated, and the entire drainage expense amounted to \$3,000. In this instance, it is estimated that the ditching operation cut \$17,000 from the cost of clearing the land.



DIFFICULT CLEARING OPERATIONS (left) are involved in removing thick growth from sloughs and swamps. In foreground lie remains of old blockade whiskey still.



RIGHT-OF-WAY FOR DRAINAGE CANAL (right) from swamp to Tennessee River is cleared of trees and undergrowth preparatory to digging.



SEVEN REINFORCED-CONCRETE PIERS carry steel-and-concrete highway deck across Rapidan River, at Germanna Ford, Va. Cross struts connect columns of river piers above water line.

Two Mixers and Trestle Runways

Serve Bridge Foundations

IN BUILDING a new bridge which replaces an old through-truss structure and improves alignment on Virginia State Route 3 at Germanna Ford, on the Rapidan River, Cobb & Homewood, contractors, of Chapel Hill, N. C., placed a small mixer on each bank of the river and delivered 600 cu.yd. of concrete for the seven

piers and two abutments in hand carts over pole trestle runways rising 45 ft. above the stream. Mixing water for both mixers was supplied from the west bank, an elevated tank on this side affording sufficient pressure to feed by gravity through a pipe line to the mixer on the opposite bank.

Height of the runways was deter-

mined by that of the piers, which extend about 45 ft. above water. Pier foundations are on rock about 8 ft. below normal summer flow level. To excavate for the footings, the contractor constructed box-type cofferdams consisting of two lines of timber sheeting filled in between with puddled earth. The cofferdams were kept dry with one double-diaphragm and two single-diaphragm Domestic 4-in. pumps.

Trestle runways from the two mixers served the construction of six piers. For one pier in the middle of the stream, the contractor built a runway from a pier of the existing bridge and ran it up a slight incline to the top of the pier under construction. At all piers, the buggies dumped the concrete into tremie chutes which discharged into the forms. Above the foundations, each pier consisted of a bent with two reinforced-concrete columns and a deep cap girder. The columns of the river piers were tied by a strut above the water line. Concrete was mixed in a Rex 7-cu.ft. and in a Jaeger 10-cu.ft. machine.

Substructure concreting began April 24 and was completed June 6. After steel girder stringers had been placed



G. B. WILLSON (left), inspector in charge for Virginia Department of Highways, and C. E. CARR, superintendent for Cobb & Homewood.



POLE TREESTLE RUNWAYS from mixers at two abutments carry concrete to six piers. Elevated tank on opposite bank supplies water to mixer in foreground. Bridge replaces old structure at left and eliminates sharp curves in highway approaches.

on the piers, the contractor concreted the reinforced-concrete deck, 454 ft. long, between June 20 and July 19, using the two-bag mixer and pouring all but two spans from the east end, where loaded buggies had the advantage of a 3 per cent downgrade. The job was completed without any accidents except scratches and nail wounds.

W. R. Glidden is bridge engineer for the Virginia State Department of Highways, J. M. Hagan is district engineer, and W. W. Sanders is resident engineer. G. B. Willson, inspector, was in charge at the site. For the contractors, Cobb & Homewood, C. E. Carr was superintendent.

Getting Down to DETAILS

Close-up Shots of
Job Methods and Equipment



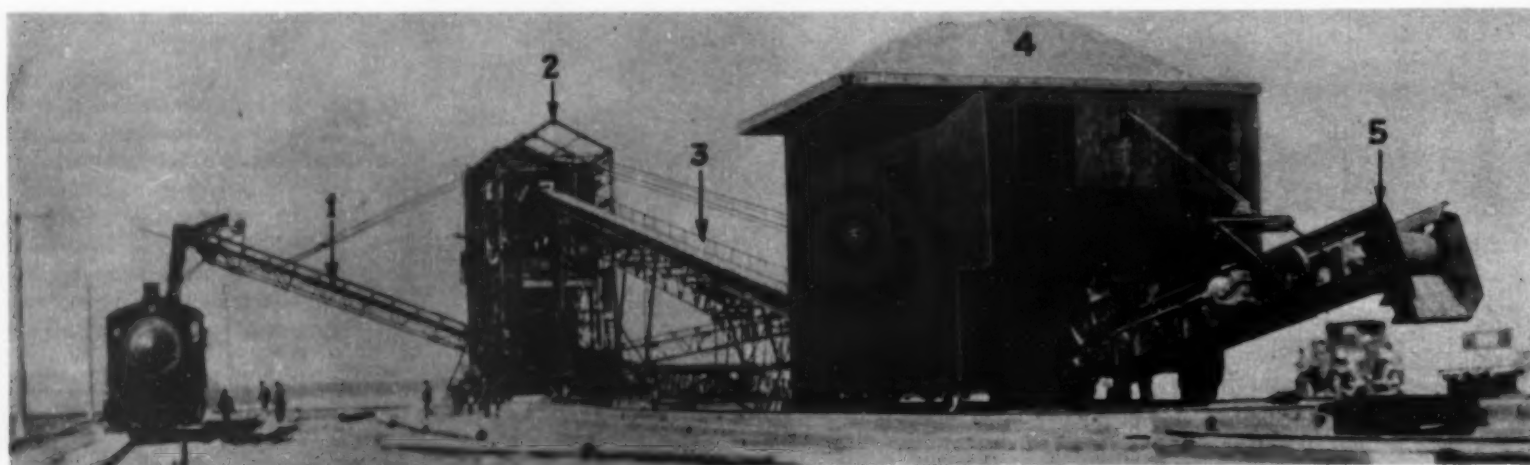
ASPHALT PLANKS on welded steel-channel deck of interlocking type protect membrane waterproofing and serve as base for stone ballast to carry single-track of Reading railroad bridge over Susquehanna River between Rupert and Catawissa, Pa. Type of flooring is said to save 110 lb. per square foot in dead load as compared with solid deck of conventional slab type. Troughs of Belmont steel deck channels are first plugged with tight-fitting asphalt filler plank to level up surface for applying membrane waterproofing mopped with hot asphalt. Upon membrane Johns-Manville asphalt bridge planks 8 in. wide, 3 ft. long and from 1 to 1½ in. thick are laid and sealed with hot asphalt as protective coating to support stone track ballast. Phoenix Bridge Co. was contractor for steel superstructure.



A-SHAPED SPIKE-TOOTH HARROW of L.P. Cavett Co., Lockland, Ohio, contractor, thoroughly mixes crushed limestone aggregate and asphalt cutback or emulsion on retread construction of 3½-in. (designed depth) mat for Indiana State Highway Department. Harrowings after each of two applications of 0.5 and 0.55 gal. per square yard produce good coating of stone and facilitate rolling. Light pin-harrow drag attached to spike-tooth harrow shapes surface and eliminates blading.

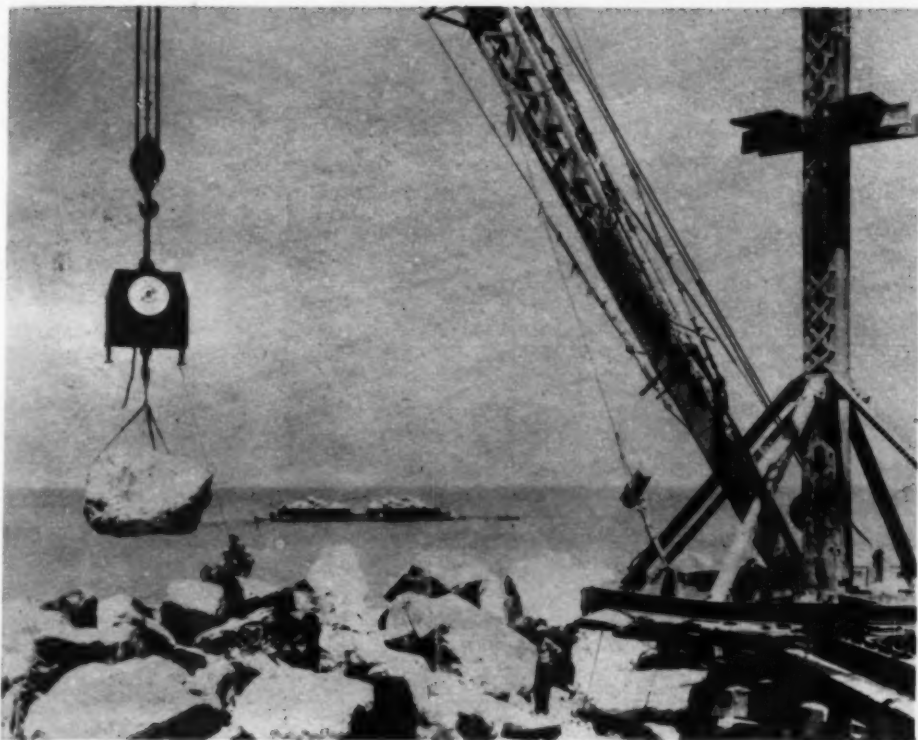


AUXILIARY TIMBERING is employed to strengthen support for Colorado River aqueduct tunnels in "squeezing" ground. Normal support consists of horseshoe-shaped steel ribs, of two sections each, bolted together at crown and resting on 6x8-in. sills or 6x8-in. spreader. Rings of 12x12-in. timber, outside of the 6-in. steel I-beam ribs, are added only when ground pressure distorts steel ribs. Design of ribs by Metropolitan Water District of Southern California allows net thickness of 7 in. for concrete lining at spring line and 9 in. at crown.

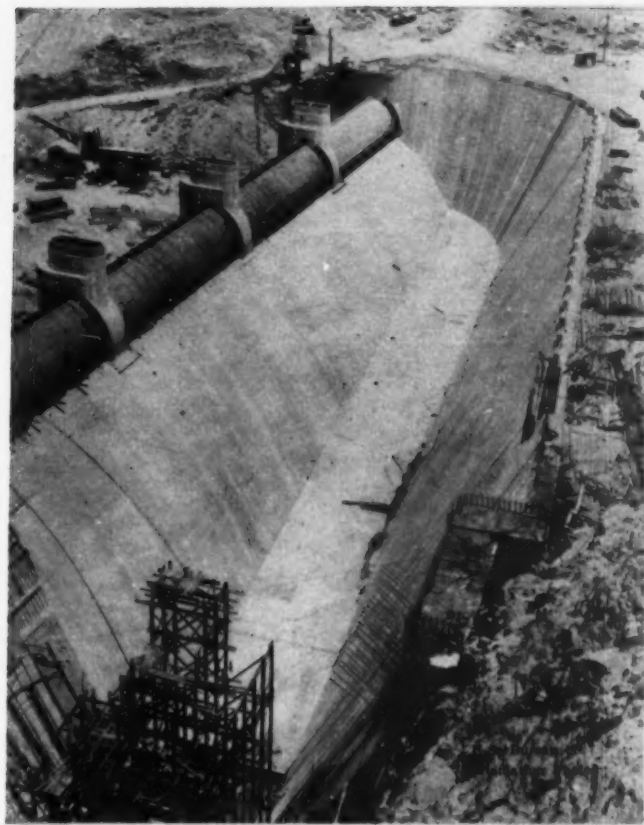


TRAVELING GRAVEL SCREENING AND LOADING PLANT supplies material for toe of Fort Peck dam on Missouri River near Glasgow, Mont. Link-Belt outfit, operating on wide-gage tracks at Cole, Mont., 75 mi. from dam, is fed by 6-yd. dragline and moves along as material is excavated. Main features of plant are (from left to right):

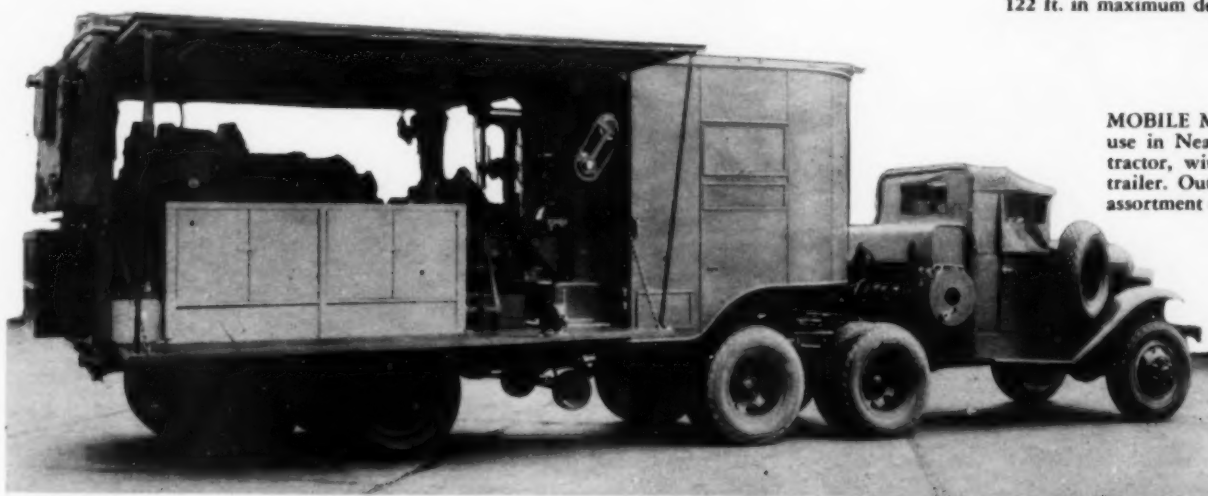
(1) Boom conveyor loading gravel into railroad cars for shipment to Fort Peck; (2) screen house; (3) main belt conveyor; (4) hopper building; and (5) boom conveyor loading boulders into truck. Toe gravel for dam includes sizes from ½ to 6 in.; all sand below ½ in. is wasted.



CRANE SCALE weighs rock placed in breakwater at Long Beach, Calif. In order to keep accurate record of material handled from quarry on Catalina Island, Rohl-Connolly Co., contractor, rigs Fairbanks scale on hook of steel derrick. Breakwater under construction is second unit, 4,000 ft. long, of 12,500-ft. extension of Long Beach-Los Angeles breakwater to increase still water anchorage. Crane scale has a capacity of 20 tons.



SPILLWAY CHANNEL, on Arizona side of Boulder dam, is lined with concrete 24 in. thick and equipped along crest with four 16x100-ft. steel drum gates to control flow. Channel wastes into inclined tunnel making connection with outer diversion tunnel used to carry flow of Colorado River during construction of dam. Spillway channel is 700 ft. long and 122 ft. in maximum depth. Side slopes are 2 on 1 and bottom width is 40 ft.



MOBILE MACHINE SHOP (left), intended for desert use in Near East, is mounted on Marmon-Herrington tractor, with all six wheels driving, and large semi-trailer. Outfit serving construction project carries full assortment of modern machine tool and wrecking equipment, including gasoline-driven motor-generator set, air compressor for riveting hammer or other heavy duty, water pump, 200-amp. electric welder, heavy-duty drill-press, milling machine, lathe, bench grinder, bearing press, valve refacer and blacksmith shop. Also, small tools, including drills, reamers, taps, dies, socket wrenches and carpenter's tools. An 80x45-ft. tent is carried along to cover the equipment when removed and set up. The whole outfit can be knocked down, packed and made ready for the road in 1½ hr.

LIGHTWEIGHT DRAGLINE BUCKET of 2-cu.yd. capacity is of composite aluminum-steel design, made by Harnischfeger Corp. for Boone & Wester, Louisiana levee contractors. Aluminum bucket, fully rigged with steel teeth, chains etc., weighs only 2,560 lb., as compared with 5,650 lb. for all-steel bucket, resulting in a saving in weight of 3,090 lb.



TRUCK-MOUNTED POWER SHOVEL, with ¾-yd. dipper and 14½-ft. dipper stick, is new development in mobile equipment for earth handling. Lorain unit of shipper shaft type, owned and operated by Elmhurst Contracting Co., handles top soil for sodded center strips on upper Broadway, New York City.

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A SPARK

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EASIER STARTING
SMOOTHER OPERATION
LESS VIBRATION
FEWER REPAIRS

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JOB MANAGEMENT

IN ROAD BUILDING

Third of Six Articles Dealing With Factors That Affect Equipment Selection, Operation and Dependability, Production and Cost

By J. L. HARRISON

Senior Highway Engineer, U. S. Bureau of Public Roads,
Washington, D. C.

— 3 —

Equipment Dependability

IN THE PRECEDING chapter in last month's issue a question was raised as to the importance of the dependability of equipment from the standpoint of job management. It would, perhaps, be proper to dismiss this question with the bare statement that equipment which lacks dependability so completely lacks usefulness that it should be replaced. However, some discussion of the reasons which justify it follow:

Dependability Factor—As the term "dependability" is not one in common use in discussions of equipment it may be noted that, as used here, the term alludes to the condition of a machine in which there is a high degree of freedom from mechanical difficulties which cause loss of time. If a machine loses no time we say that it has a dependability factor of 100, meaning 100 per cent or perfect operation from the mechanical standpoint. If it has a dependability factor of 90, we understand that 10 per cent of the working time is lost through delays caused by mechanical difficulties. These delays may be caused either by breakdowns or by the tendency of parts of the machine to get out of adjustment. Anything related to the mechanical aspects of a machine which causes it to lose working time reduces its dependability factor.

In the opinion of the writer the importance of dependability has usually been underrated and this largely because, in the first place, job management is commonly thought of as a management of men whereas it has come more generally to be a management of machines and in the second place because there is a widespread tendency to "hope" that the time a machine loses can be "caught up." It will not be necessary to examine the fallacy of these conceptions here. The fact that the present-day management of highway construction—and this is equally true of many other lines of construction—is a

management of machines has been discussed in a previous chapter. So has the inflexibility of any large organization and its consequent inability to speed up and, in so doing, wipe out the effect of time that is lost. It will, therefore, be assumed that job management as a management of machines is accepted and that the physical impossibility of "catching up" lost time is a fact of wide, if not of universal, applicability.

From the standpoint of job management we then face two facts: First, the daily cost of working (the number of work-dollars spent each day) is pretty definitely constant; second, as the job is tooled and manned for a given rate of output not subject to quick alteration any subtraction from the time worked, whether this be a minute here

and a minute there or 10 min. or a half-hour now and then, subtracts from the production for the day. Inevitably, then, if the equipment causes delays production is reduced and with this reduction there is a corresponding reduction in the amount of production obtained per work-dollar expended.

Delays Expensive—There is another aspect of this matter which deserves comment. When a job is tooled and manned for a specific rate of output and an important equipment unit causes repeated small delays, there is no possibility of adjusting either the tooling or the manning of other processes to allow for these delays. They occur at no set interval and continue for no set period. Moreover, between these delays production must proceed as nearly as possible at the rate for which the

job is tooled and manned. For these reasons time—that is, production—lost because of delays of this nature is expensive, for daily cost goes on without regard to them. True enough, under some circumstances, the payments made to labor are at least partially adjusted on account of the longer delays of this character but even when this is done the costs generated by the equipment for the most part remain. Without much regard to pay and to other practices which it is possible to establish in an effort somewhat to reduce the effect of equipment delays, these delays are expensive and, in the nature of the case, unavoidably so.

Just how expensive a reduced dependability factor is varies, of course, from job to job, for the number of work-dollars spent per day varies widely. Different types of work involve wide differences in the amount and value of the equipment used, in the applicable rates of depreciation, in the number of men employed and in the wages paid. However, for any specific job the ordinary expenditure per day (in work-dollars as defined in the first article of this series) can be determined pretty accurately. For a highly mechanized grading job the daily expenditure (in work-dollars), depending on the kind of equipment used, may easily run from \$150 to \$200. For a paving job this daily expenditure is likely to run from \$350 to \$450. Often it runs even higher than this.

Costly Minutes—Taking, then, a specific paving job on which the daily expenditure in work-dollars is \$400, it is apparent that each 1 per cent by which the dependability of a key producer or of any other piece of equipment which, in stopping, tends to stop the job, costs the contractor 1 per cent of his daily outlay for performing this work, or \$40. Or, if this matter is stated a little differently and it is assumed that the work is handled on a 10-hr. day basis, which is 600 working minutes each day, each minute lost costs the contractor from 60 to 80c., depending on his daily expenditures for



MODERN EQUIPMENT must possess dependability under most exacting conditions of service. Adams power-controlled grader, hauled by Cletrac tractor, builds 12-ft. road on steep mountainside in Angelus National Forest in California.

labor and equipment. Rates even higher than this are not uncommon.

Taking 70c. a minute as a normal estimate of the value of lost time in the concrete paving field, any machine that causes the average loss of half an hour (30 min.) a day is, then, costing the contractor \$21 a day or from \$3,000 to \$4,000 a year, depending on the length of the working season.

It is likely to seem to many of those who read this article that time losses due to breakdowns or stops for adjustments can seldom be as large as this. The fact is, however, that even in good times when old equipment normally is replaced by new equipment at rather frequent intervals, the amount of equipment which develops time losses as great as this—that is, the amount of equipment which has a dependability factor of 95 or less—is rather large. After three years during which replacements have been far below normal, the amount of equipment now in use which has a low dependability factor must be large, in spite of the fact that the general stamina of construction equipment has been greatly improved during the last ten years.

It will, of course, be apparent that the relation between the cost of a low

"When a job is tooled and manned for a specific rate of output and an important equipment unit causes repeated small delays, there is no possibility of adjusting either the tooling or the manning of other processes to allow for these delays."

dependability factor and the value of a specific unit of equipment varies widely. Obviously it is different for a power shovel than for a paver and still different for an elevating grader. In general, however, the fact remains that a comparatively small loss in dependability generates so much expense on account of time (production) lost that it is more profitable to replace the unreliable equipment unit than to retain it. Equipment that has lost some of its dependability is pretty certain to lose more of it as time goes on. This is the universal experience with equipment. Even extensive field repairs are but a temporary, and usually an expensive, palliative. Wear and tear are progressively destructive and when they have reached a point where a day-to-day loss of time, as the result of their effect, is the usual experience, the most profitable course is to obtain new equipment.

The adverse direct effect on the amount of production that is procured per work-dollar spent is comparatively easy to demonstrate as the inevitable result of low dependability. In the case

STEADY PERFORMANCE is requirement for this Lorain crawler crane supplying sand and stone to batching plant serving huge 5-yd. truck mixers on concrete highway job in Massachusetts. Here is a case where crane, not mixer, becomes "key producer."



of any specific unit of equipment evidently lacking proper dependability, the lost time can be measured as it occurs. While determination of the value of this lost time will not, in all cases, be absolutely exact, it will be quite sufficient to guide the owner in deciding how prospective profits are affected by keeping this unit in service. In these days profits are so narrow that it takes very little loss in the dependability of important units of equipment to destroy them entirely.

The writer has seen a good many jobs on which the shovel could not be

depended on to work more than 9 hr. out of a 10-hr. shift. In a great many of these cases it was apparent that the \$20 to \$30 or more per day this loss of production time was causing exceeded the profit which had been expected as a result of taking the work. This matter might be considerably amplified, but to do so would be merely to add emphasis to the obvious conclusion that when profit margins are normal—and even more so when they are narrow—the prospect of securing a profit depends very largely on the dependability of the equipment used.

Maintaining Production—While the direct cost of lack of equipment dependability is an important matter it is not the only matter and quite often not the most important matter to be considered in studying dependability. Having tooled and manned, for a given rate of output, the various processes by which production is to be obtained, the problem of the management is to keep the organization operating at that rate. Always there are a thousand and one little things that must be looked after if the organization, taken as a whole, and the parts of it, taken separately, are to maintain this rate. The maintenance of a scheduled rate of output is not a simple thing at the best, and at times it is extremely difficult. Above all, however, it requires careful planning on the part of the job management—a planning which foresees difficulties long before they arise and so is prepared to meet them when they do arise—and the development among the men of a keen appreciation of what they must do and the operating details they must observe to maintain the scheduled rate.

It is at this point that the adverse effect of using equipment which lacks dependability is more destructive than

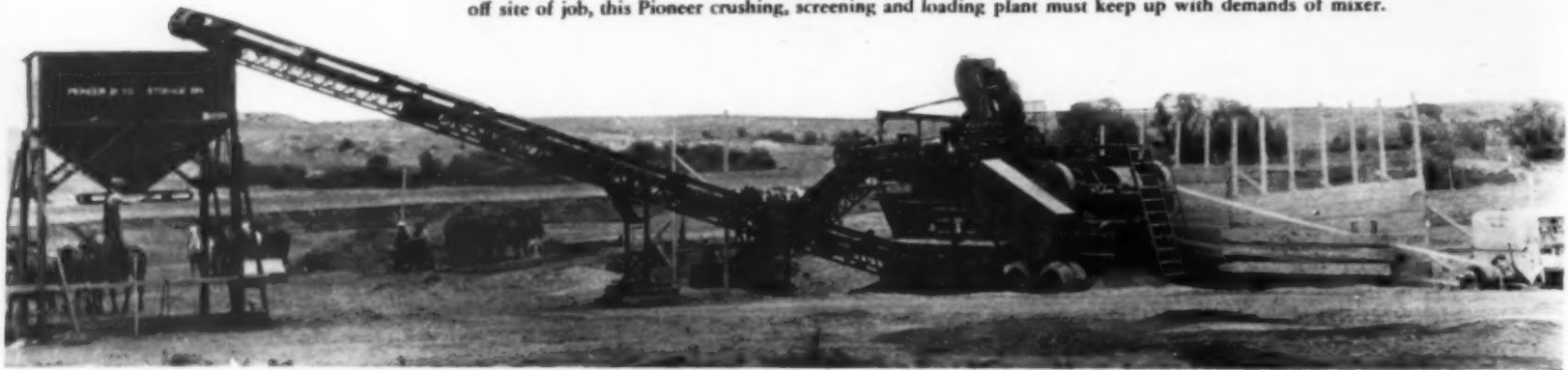
"A comparatively small loss in dependability generates so much expense on account of time lost that it is more profitable to replace the unreliable equipment unit than to retain it."

it is in the direct subtraction it makes from working time. The best job superintendent is unable to plan ahead for breakdowns. He is equally unable to prepare his men to meet them. There is nothing to do in the face of equipment delays but to wait till the cause is remedied. The inevitable result is that where delays occur with any frequency the men "lose their stride." Ultimately, in the face of repeated delays, they lose their morale. Not infrequently they become so dissatisfied that they leave the job. But, without regard to the degree to which stops occasioned by breakdowns destroy the spirit of the men, some loss on this account is to be expected whenever a job is stopped repeatedly and if such stops are at all frequent the maintenance of a planned rate of production becomes quite impossible. This loss applies over the whole period work is done and for this reason a loss which, from the percentage standpoint, is not very large may mean a good deal when charged against the machine that is responsible for it.



RUGGED CONSTRUCTION must be built into modern equipment to insure against delays due to breakdowns. Frozen ground presents no operating problem to hydraulically-controlled plow of this Austin-Western elevating grader.

CONTINUITY OF MATERIALS SUPPLY is necessary factor in maintaining production rate. Though off site of job, this Pioneer crushing, screening and loading plant must keep up with demands of mixer.



Losses of this-kind are far less tangible than are the losses of time (and of production) which low dependability causes. Nevertheless, they arise from the same cause and as they can be even more serious they should be considered in any study of the effect of low dependability. The man who "just can't get the job to running right" more often than not is "fighting" poor equipment and

general effect on the men which results from having what, in at least some parts of the country, is known as a "hay-wire" outfit. Men who join such an outfit realize instinctively that it cannot be made to operate on an efficient basis. This realization works in two widely different ways both of which tend to make production worse than it might otherwise be. In the first place,

of the day, for normal effort. The result is a generally low standard of effort which works powerfully to defeat the attainment of good production when things are running properly, as they will now and then even on a poorly equipped job.

In the second place, while poor equipment always means recurring short delays during which the men are kept

to hire men who are weak and undependable. They cannot be trained or organized for effective effort. The same thing is basically true of machines which are in poor condition. They cannot be organized nor can their operation be so systematized as to yield a satisfactory output. Probably this has been true ever since men began to use machines, but it has become increasingly true as the management of construction has become more and more a management of machines. Today in most lines of highway construction job management is so entirely a management of machines that it may be set down as fundamental that where undependable machines are in use their effective management is impossible and, therefore, that where they are used satisfactory rates of production are unattainable.

The obvious conclusion is that profit and manageable machines must be closely related. Results confirm this conclusion. In good times some degree of undependability may be absorbed without destroying profit. In normal



ON A HIGHLY MECHANIZED GRADING JOB daily expenditures in work-dollars may run from \$150 to \$200. Costly delays are avoided by using dependable equipment.

the low morale this poor equipment has caused, with the result that he can get neither a full utilization of the working day nor the full rate of production when his force is at work.

"Hay-wire" Outfits — A still more intangible factor which presents itself on any job on which the equipment obviously is in poor condition is the

the men who join such an outfit do not expect to make full time or to work very hard even when there is an opportunity to do so. They seem instinctively to know that the job must be equipped for some rate of production and manned accordingly and that as this rate cannot be maintained much of the time they will not be called on, during much

on the job and paid for the time they nominally put in, it also means a good many longer delays for which time is deducted. Here the result is to drive away good men, for normally good men will stay on a job only when they can draw pretty nearly full wages. The same is true of the owners of good hauling equipment. The effect of this process is progressively to develop a crew of second-rate men and, if the hauling equipment is rented, to leave only poor equipment on the job.

In these fields which, while closely related to the loss of morale due to repeated breakdowns nevertheless, in their nature, are somewhat different, the losses poor equipment develops may be quite large. In fact, they may be so large that it is pretty safe to say that in combination with other effects, direct and indirect, of using equipment which has a low dependability factor, they serve to destroy all prospect of profit. The writer has yet to see a job where the equipment was admittedly in poor condition on which there was any evidence of profitable operation.

To summarize this matter, it never is profitable to operate poor equipment. Every one realizes that it is unprofitable

"The man who 'just can't get the job to running right' more often than not is fighting poor equipment and the low morale this poor equipment has caused."



ON LOCATIONS far removed from industrial centers spare parts can not be had quickly in case of breakdowns. Machines must carry on without necessity of repairs.

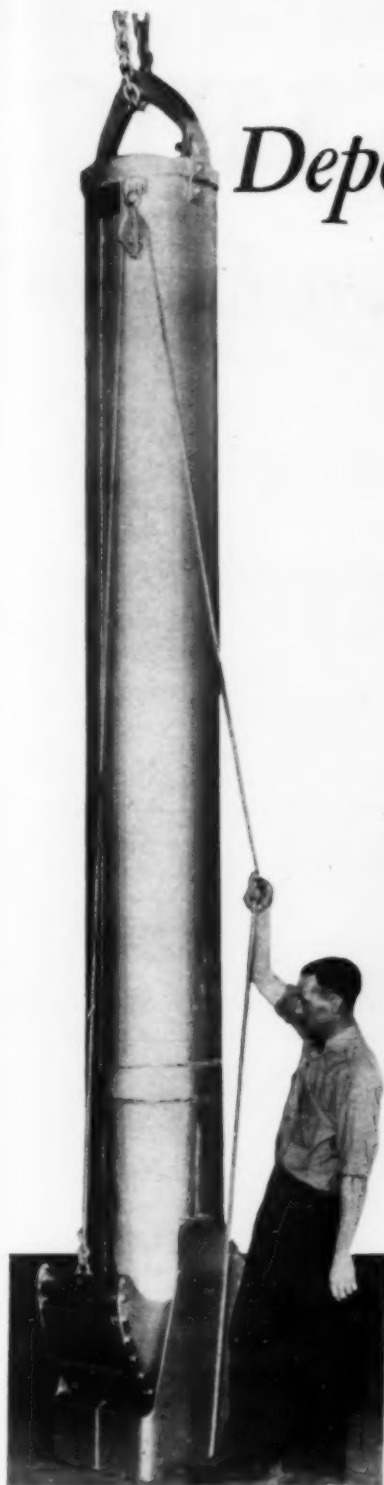
times a profitable standard of production requires a somewhat higher degree of dependability in the machines used. When times are such that margins of profit are low, profit is possible only when the rates of production are high and well maintained, a situation which can be developed only by the use of thoroughly dependable equipment. It follows, quite logically, that the worst of all times in which to experiment with poor equipment are those times when margins of profit are low.

♦

NEXT MONTH — Continuing this series on Job Management, Mr. Harrison will discuss in the June issue, "Power Shovel Grading Operations."

SLIM BUCKET

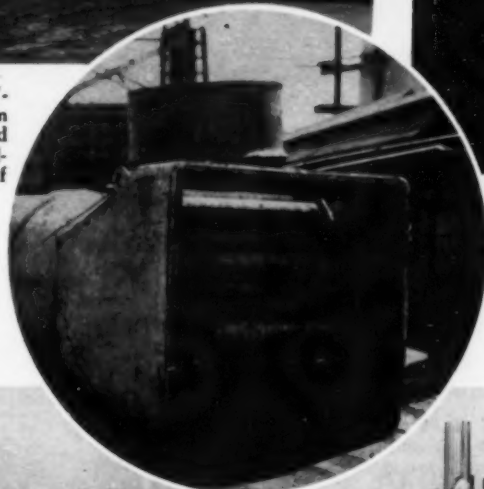
Deposits Concrete in Tight Places



SLENDER ROLLER-GATE BUCKET 14 ft. high is designed to carry 22 cu.ft. of concrete into tight places.



PARTLY LOWERED into column form, bucket is fed by hopper suspended from boom of second crane.

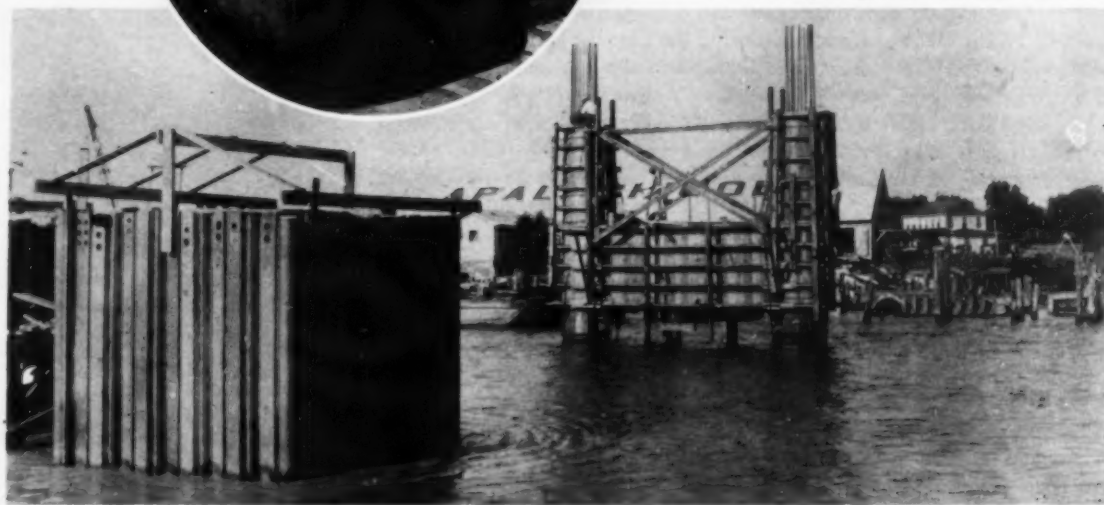


BUCKET DESCENDS (*below*) into narrow opening between column reinforcing rods.



COMPACT GATE MECHANISM (*left*) is housed in close-fitting rectangular shell.

SLENDER COLUMN FORMS and pier caissons (*below*) of Appalachicola bridge require concrete bucket of special shape to enter narrow openings between steel rods.



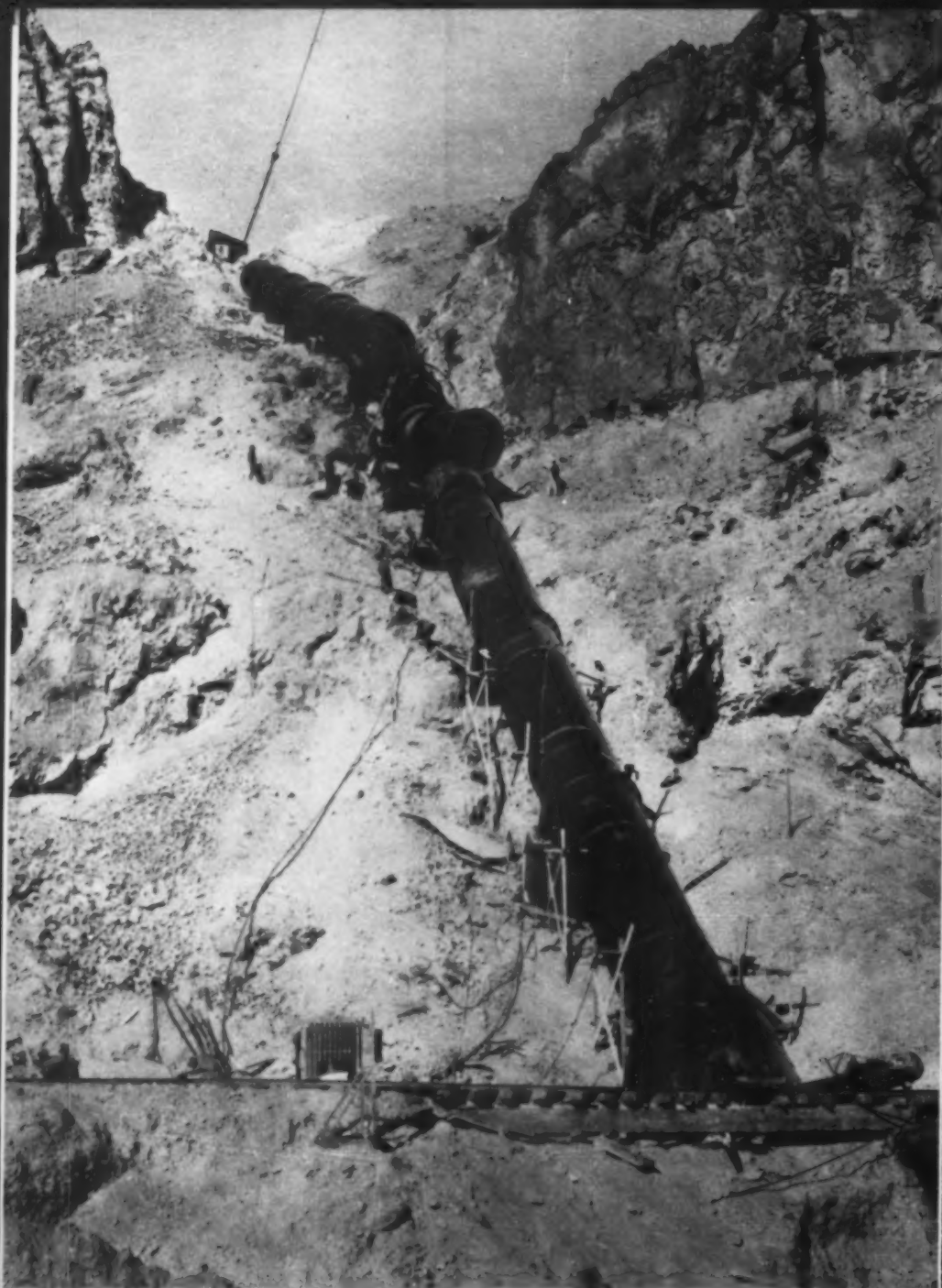
TO PLACE CONCRETE in high forms and in restricted spaces between steel reinforcing rods, the Hardaway Contracting Co., of Columbus, Ga., contractor on nine piers for the swing span and six approach spans of the Appalachicola Bay bridge, Appalachicola, Fla., ordered a long, slender roller-gate bucket from the Blaw-Knox Co. The bucket, 14 ft. long and 18 in. in diameter, providing a water-level capacity of 22 cu.ft., is the only one so far built to these dimensions to meet special requirements. It served its purpose satisfactorily in depositing concrete in the narrow intervals between reinforcing bars inside the pier forms.

Franklin County is building the

bridge as part of a project involving, in addition to the bay structure, about 3 mi. of 25-ft. steel-and-concrete approach spans on treated timber pile bents, 2 mi. of causeway, and 1½ mi.

of roadway approaches. The project was financed by a loan of \$1,500,000 from the Public Works Administration and is being constructed under the engineering supervision of the State Road

Department of Florida, J. H. Dowling, state highway engineer. R. E. Hardaway, Jr., of the Hardaway Contracting Co., supplied most of the accompanying photographs.



HILLSIDE SECTION of Owyhee siphon on north side of Owyhee Canyon practically completed, with only one joint remaining to be made.

ELECTRIC

in Two Large



OWYHEE SIPHON, with lower 700-ft. section across Owyhee Canyon completed. Trestle flume in background carries flow of Owyhee River while pipe is laid.

TWO HUGE SIPHONS, one 10½ ft. and the other 9 ft. in diameter, have been constructed by arc welding on the Owyhee River in eastern Oregon for the U. S. Bureau of Reclamation. The 9-ft. pipe was welded into one solid tube 1,630 ft. long. The 10½-ft. section is 900 ft. in length. Both were constructed of pipe and materials furnished by the federal government and are a part of the North Canal in the Mitchell Butte division of the Owyhee project.

On June 1, 1934, the first pipe to be installed in the Owyhee siphon was placed in the bottom of the Owyhee Canyon. This section of the project is 700 ft. in length and is constructed of 9-ft.-diameter pipe, fabricated from 3/16-in. steel plate. The pipe was placed in a trench 29 ft. deep and was completely incased in concrete. A photograph shows this section of the line after it had been installed.

After the lower section was welded in place, heavy heads were welded on each end, and the line was tested to 200

lb. per square inch for a period of 12 hr. Following this test, the effective operating pressure was held in the line during the time the concrete was being placed and for 10 days afterwards, making a total test period of approximately 30 days. No leaks were found in the field welds. Field joints on the incased portion of the Owyhee siphon were butt vee type with no backing-up strap, while the joints on the exposed section were butt vees with an outside butt strap ¾ in. thick.

High Temperatures Cause Difficulty—High mid-day temperatures (125 deg., F., in the shade) caused some difficulty in fitting the joints. In the case of the flat river section, after the string became more than 200 ft. in length, the top of the pipe had a tendency to become longer than the bottom. A method was devised whereby the tops of the sections were secured by tack welding and the bottoms by pull jacks, leaving a gap at the bottom sometimes as much as ¼ in. greater than the top gap. The following morning, with the

temperature equalized, no trouble was experienced in bringing the pipe flush and tack welding.

Welding was accompanied by thorough peening with pneumatic tools.

Skilled pipe welders were qualified by test. Two-thirds of the joints required staging inside and out because of the steep grades. A total of 13 passes and 41 hr. were required for each 13/16-

WELDING *Fuses Pipe Joints*

Owyhee Siphons

42-DEG. SLOPE (*below*) in this portion of Owyhee siphon. Pipe on hillside ranges in thickness from $\frac{3}{8}$ in. to $\frac{3}{16}$ in. Exposed pipe joints are butt-V type, with outside butt straps $\frac{3}{8}$ in. thick.

PIPE SECTION (*below*) for Owyhee siphon, 9 ft. in diameter. Plate thickness in this siphon varies between $\frac{3}{8}$ in. and $\frac{3}{16}$ in.



in. butt vee joint. The trestle shown in the photograph already referred to was used for diverting the Owyhee River while the pipe was being laid. Plate used in the hillside pipes ranged from $\frac{13}{16}$ in. to $\frac{3}{8}$ in. One of the hill-sides has a grade of 88% at its steepest point.

Sniveley Siphon—About 3 mi. from the Owyhee siphon is the Sniveley siphon, a part of the same canal which goes through the Owyhee project. The pipe used in this part of the job is $10\frac{1}{2}$ ft. in diameter and ranges in thickness from $\frac{1}{2}$ in. to $\frac{3}{8}$ in. This siphon, 900 ft. long was started just after the lower crossing of the Owyhee siphon had been finished.

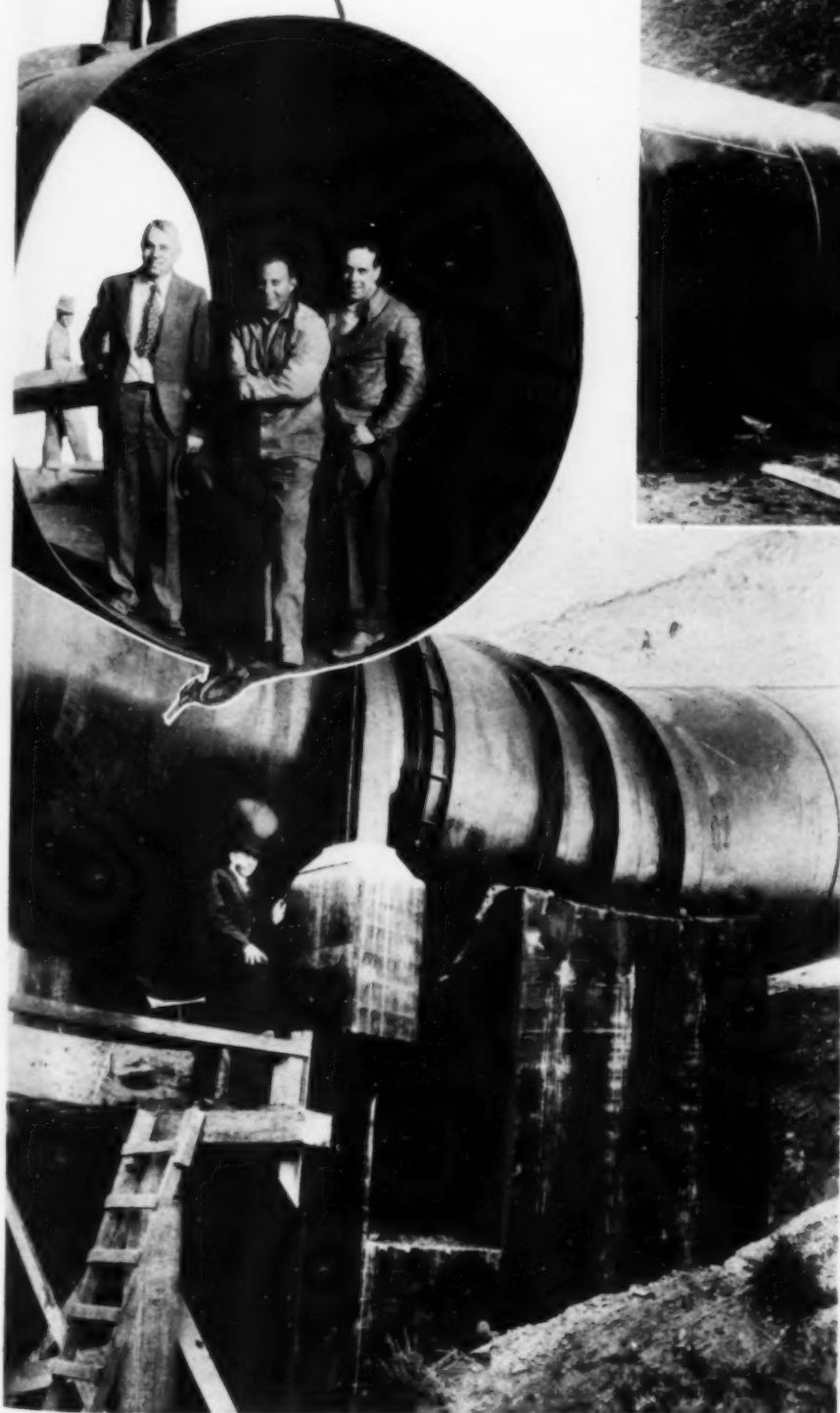
Pipe was delivered in 20-ft. lengths and placed by a crane where conditions permitted. On steep slopes the pipe was slid over the piers on rails. The pipe was entirely supported on rollers and anchors. Welded joints used in joining the pipe were similar to those used

on the exposed portion of the Owyhee section; that is, butt vee with a $\frac{3}{8}$ -in. butt strap on the outside. Each joint required nine passes and 29 hr. welding time. A test of the Sniveley siphon revealed no leaks whatever in the field welding.

A crew of approximately 25 men and four arc-welding machines handled the placing of the pipe and the field welding on these two projects. The Olson Manufacturing Co., of Boise, Idaho, placed and welded the pipe under the direction of Hanford Haynes, the superintendent. Two sizes of electrodes— $\frac{5}{32}$ - and $\frac{3}{16}$ -in.—were specified by the U. S. Bureau of Reclamation. Lincoln welding wire was used. The pipe was furnished by the Chicago Bridge and Iron Works.

Both siphons would have been completed in much shorter time had the government not decided to stress-relieve the field welds. This relief was given by using an oil-fired portable ring furnace which heated the joint to 1,100 deg., F., at which temperature it "soaked" for about an hour and then was allowed to cool gradually. Temperatures were recorded by thermocouples at eight points on the ring.

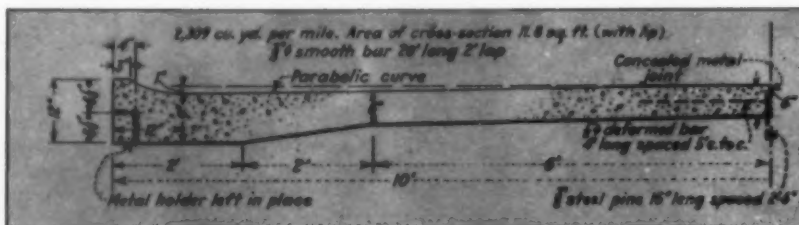
EXPANSION JOINTS AND ANCHORAGES (*left*) of Sniveley siphon, $10\frac{1}{2}$ ft. in diameter and 900 ft. long.



LIP CURB

Built Integral With Concrete Pavement

THE LIP CURB for concrete pavements, started in Iowa, has been adopted by several mid-western states. As described by E. M. Fleming, manager, Highway and Municipal Bureau, Portland Cement Association, in an address before this year's convention of the American Road Builders' Association, the lip curb is from 3 to 4 in. high, has a gently sloping face and a base width of 12 in. It is constructed, as shown in the accom-



LIP TYPE OF CURB, as designed in Missouri, has rise of 3 in. and is built as part of concrete pavement.

panying series of photographs, by depositing concrete for the curb on top of the slab after finishing.

In the original construction wooden forms of the proper height were bolted on top of the steel forms after the last passage of the finishing machine. Steel forms have now been developed for this purpose and they are provided with a clamp that fastens them in place in much less time and with much less labor than was used in the bolting system.



1 METAL FORMS are clamped in place, an improvement over former practice of bolting wooden strips to top of road forms.



5 SPECIAL METALLIC FLOAT, equipped with two handles is employed to produce smooth curb surface.



2 CONCRETE is brought back from paving mixer and deposited along inside edge of curb forms.



6 FORMS (left) of steel and floating tools used in construction of concrete lip curb.



3 SHAPING of lip curb is done with hand-operated screed.



4 STRIKE-OFF is used to bring curb to proper finished contour.



7 WOOD FLOAT touches up any irregularities in surface of curb.



8 STEEL FLOAT, curved to proper shape, gives final finish to curb.

Present and Accounted For—

A Page of Personalities



GALLIPOLIS LOCK BUILDERS. (Left to right) J. Hippert, general superintendent, J. S. Miller, president, and Edward ("Red") Weiher, superintendent, of the Dravo Contracting Co., Pittsburgh, which is constructing within 16-acre cofferdam on Ohio River below Gallipolis, Ohio, pair of locks and dam to cost \$6,263,000, as described elsewhere in this issue.



HEADS A.G.C.'S "HEAVIES."—C. V. Burghart, vice-president and treasurer of the Bates & Rogers Construction Co., Chicago, has been appointed chairman of the Heavy Construction and Railroad Contractors' Division of the Associated General Contractors of America.



RHODE ISLAND'S STATE HIGHWAY ENGINEER. Major John H. Caton, 3rd, has been named chief, Division of Roads and Bridges, Department of Public Works of Rhode Island. During the World War Major Caton commanded the 33rd Engineers, A.E.F., in France and lately served as state engineer for the PWA in Rhode Island.



S. M. GRIFFITH, president, Griffith Co., Los Angeles, has completed a year's term as president, Southern California Chapter, A.G.C.



H. T. REYNOLDS, Jr., president, Reynolds - Ely Construction Co., Springville, Utah, has completed a year's term as president, Intermountain Branch, A. G. C.



H. S. WALTERS, with background of contracting and banking experience, is newly appointed Commissioner of Highways and Public Works of Tennessee.



STEPHEN A. SCULLEN, president, S. A. Scullen, Inc., Cohoes, N. Y., has been chosen president, New York State Highway Chapter, A.G.C.

NEW EQUIPMENT ON THE JOB

FOR PREVENTING SOIL EROSION by terracing land with broad-base terraces, this two-wheeled direct-hitch type of machine called a terracer (*below*) has been designed. It weighs approximately 4,500 lb. and is intended for use with 35 to 40-hp. tractors. Blade can be raised or lowered, reversed or side-shifted, with ease and speed, all adjustments being made from platform where operator has clear view of blade at all times. Machine has strong, rigid frame of box-girder type. Blade-raising mechanism consists of cut worms and gears operating in grease in dustproof housings. Adjustable type gooseneck tractor hitch. Wheel tread, 60 in.; standard blade, 10 ft.; but special blades may be had. — Austin-Western Road Machinery Co., Aurora, Illinois.

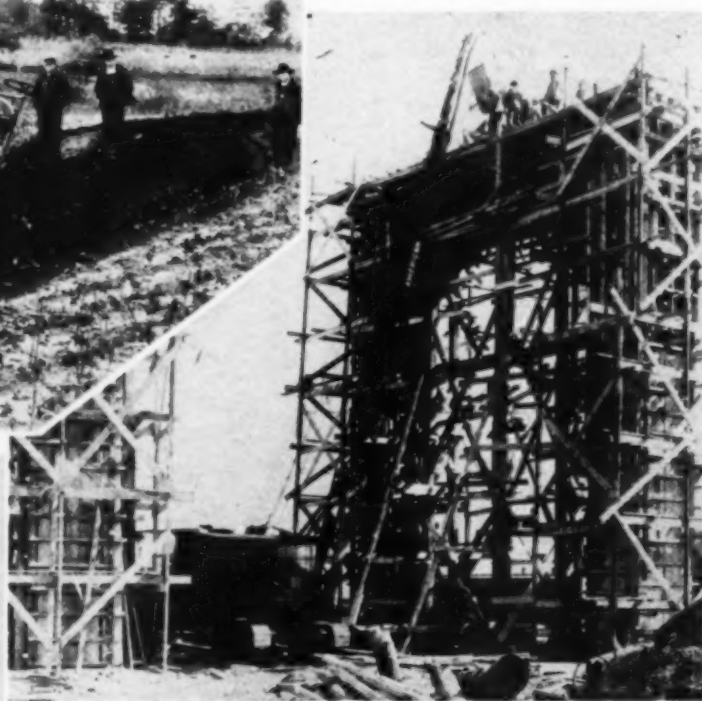


TRAILER-TYPE CONCRETE BREAKER (*below*) handles demolition of asphalt and concrete pavement for sewer job in Brooklyn, N. Y. Machine is trailed behind 160-cu.-ft. truck-mounted compressor. Two men handle job—one drives truck; other operates breaker. Trench is 4½ ft. wide and asphalt and concrete are broken in one operation at cost of 1¼ c. per square foot. Machine is 15 ft. long, 6 ft. wide, weighs 4,500 lb. and demolishes a strip ranging from 6 in. to 5 ft. 4 in. Equipped with steering wheel for backing into difficult positions. Hammer moves 4 ft. 4 in. horizontally. Swing driven by engine. Reciprocating hammer action. Breaker can be operated in buildings and can be pushed around by hand, rest wheel in front of machine being provided for this purpose. — Concrete Cutting Corp., 52 Clark St., Brooklyn, N. Y.



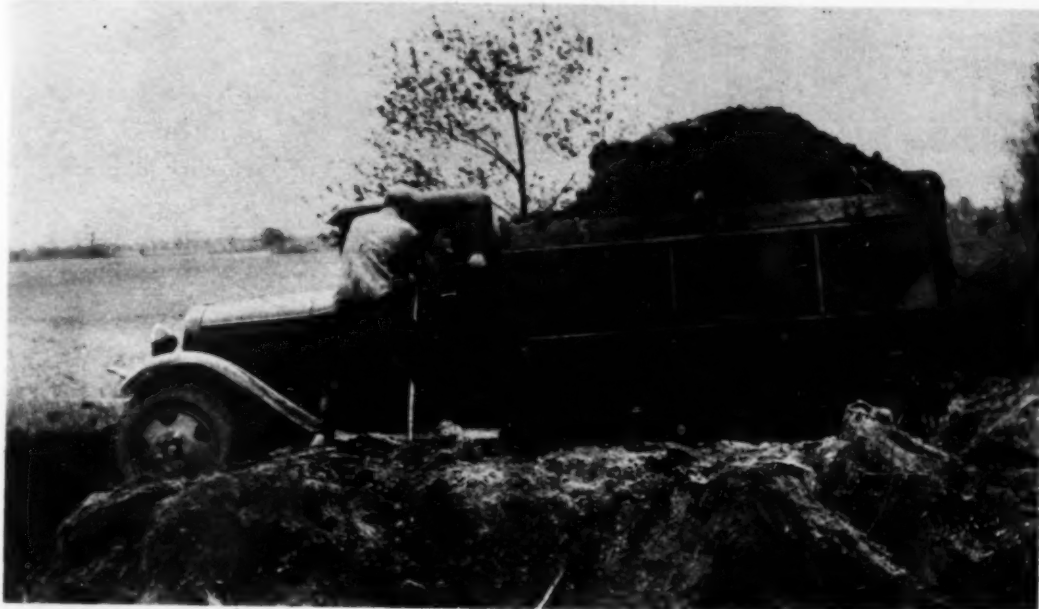
TRACTOR-SHOVEL UNIT consists of Speeder shovel mechanism mounted on Caterpillar diesel tractor. It travels at speeds up to 5 mi. an hour under its own power and negotiates any grades,

ditches or soft ground where tractor may travel. Other features: patented crowd for shovel operation; anti-friction bearings; extra heavy construction; one-man operation. Shovel boom length, 14 ft.; dipper stick, 11 ft.; crane and dragline boom, 22 ft. long. — Speeder Machinery Corp., 1201 S. 6th St., West, Cedar Rapids, Iowa.



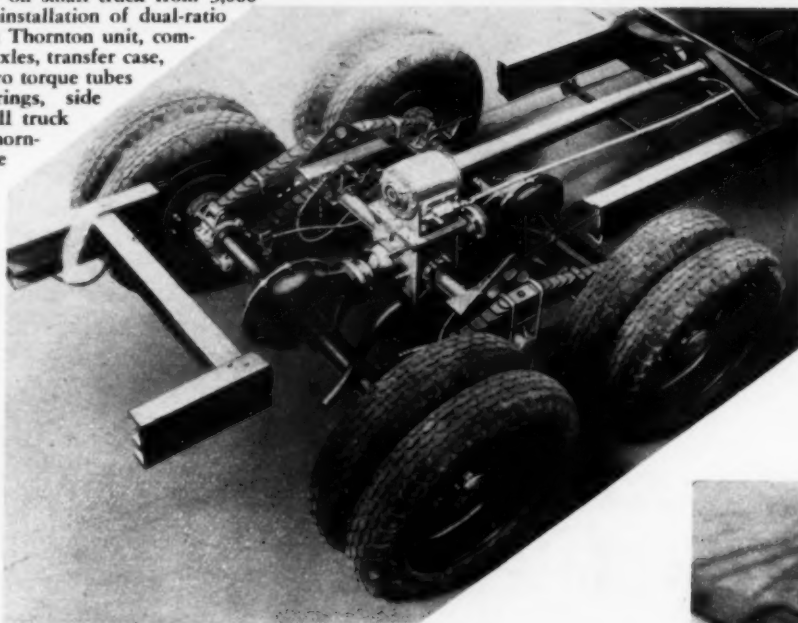
SHOVEL - CRANE - DRAGLINE (*above and at left*) of ½-yd. crawler type for gasoline, diesel or electric operation, extends range of sizes of American Gopher machines to cover field from ½- to 2-yd. capacities. High operating speeds of machine, quick convertibility from shovel to crane and simplicity of construction are claimed for machine. Other features: All-steel construction; easily operated master-control clutch; nickel-chromium steel, heat-treated, splined shafts—all independently removable; high speed shafts equipped with self-aligning ball bearings. Swinging speed, 5.15 r.p.m.; tail swing 8 ft., permitting work in close quarters. — American Hoist & Derrick Co., St. Paul, Minn.





PAY LOAD INCREASED on small truck from 3,000 to 10,000 lb. (*above*) by installation of dual-ratio four-wheel drive (*right*) a Thornton unit, comprising two standard live axles, transfer case, two rear axle couplings, two torque tubes and dual cantilever springs, side mounted. Attached to small truck chassis by gusset plates. Thornton-equipped trucks have following advantages:

- (1) Increased loads at less cost per ton mile;
 - (2) Mechanical flexibility which absorbs body sway and road shock, and reduces frame strain to minimum;
 - (3) Handled easily in traffic;
 - (4) Better load balance;
 - (5) Six-wheel brakes and greater road contact of tires reduces skidding and increases safety;
 - (6) Dual ratio provides high power for heavy load and speed for light loads.
- Thornton Tandem Co., Detroit, Mich.



STABILITY AND LIGHT WEIGHT of this FWD chassis were reasons for choosing it as mounting for Universal crane (*below*) recently put into service by New York State Department of Public Works. This truck, equipped with 3 axles and 10 tires, according to Purdue University test, has mechanical efficiency of 88.2 percent, only 11.8 percent being required to drive the

mechanism. Its traction over two widely separated axles—front axle of truck and front axle of bogey—enables it to bridge rough places in traveling from job to job. Center differential with manual lock operated from driver's seat eliminates unnecessary strain in mechanism. —Four Wheel Drive Auto Co., Clintonville, Wis.



CONSTRUCTION METHODS—May, 1935



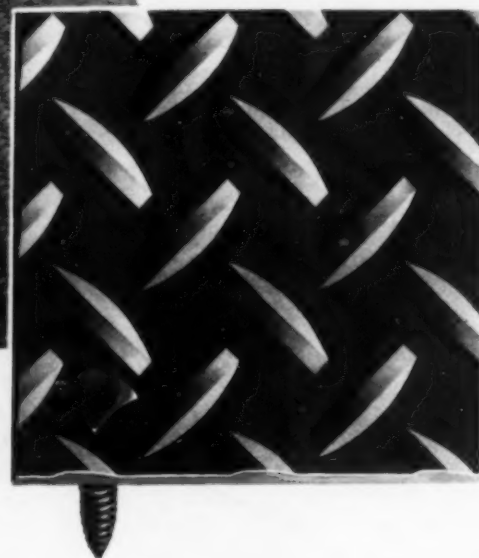
RUST-PREVENTIVE COATING for steel highway bridge is obtained by spraying surface with zinc dust-zinc oxide paint which deposits a non-porous, distensible film capable of expanding and contracting with metal. These paints are used in general for priming and finishing iron and steel, both structural and machine, for galvanized metal and sheet zinc, and for general plant, highway and public utility maintenance. They are of special use as primers on metal because of their rust-inhibiting properties, continued flexibility on iron and adherence to galvanized iron and zinc surfaces. —New Jersey Zinc Sales Co., 160 Front St., New York City.



FLUSH-PRINCIPLE LUBRICATION, by which clean oil bathes all parts and washes out gritty particles continuously, is outstanding feature of new 55-lb. portable rock drill which, according to its makers, cuts fast, reams properly, keeps hole clean and is easily handled. Another feature of note is pancake valve, operation of which results in low air consumption. Traveling but few thousandths of an inch, practically no air is used to throw valve, allowing almost full amount for drilling. As result, new drill produces maximum hole footage per cubic foot of air. One rock drill can be run from 110-120-cu.ft. single-stage portable compressor. —Sullivan Machinery Co., 400 N. Michigan Ave., Chicago, Ill.



85 tons of Inland
4-Way Traffic Plates
used on Mississippi
River Bridge at
Burlington, Iowa



LIFE INSURANCE *for* BRIDGES .. Inland 4-Way Traffic Plates

NEW bridges are assured a longer period of service, the useful life of old ones is lengthened, at low cost, by Inland 4-Way Traffic Plates.

Announced in 1931, they were immediately adopted by engineering authorities far and wide, because of the superiority of the 4-Way pattern.

Projections on 4-Way Plates overlap—reinforce—one another both lengthwise and crosswise. Extra stiffness and strength re-

sults—extra reinforcement for the bridge floor, giving it a new feeling of safety under the car.

There is equal traction 4-Ways instead of the usual two. Skidding is radically reduced, in bad weather as well as good, for the 4-Way pattern assures thorough drainage.

Inland 4-Way Traffic Plates are made in widths, lengths, and thicknesses for all needs. Write for complete information. INLAND STEEL COMPANY, 38 South Dearborn Street, Chicago, Illinois.

Extra
Stiffness

4-Way
Safety

4-Way
Drainage

INLAND STEEL

Sheets Strip Tin Plate
Plates Structurals Piling

Rails Track Accessories
Bars Rivets Billets

BOGS, BRICKS OR BOULEVARDS

*—all the same
to Goodyears*



GOODYEAR Truck Tires are built to **PERFORM**. And they do—better and longer than any other tires made. That's because Goodyears are built for the job. For every type of truck—for every hauling job, there is a Goodyear Tire that will provide the utmost in dependable, economical performance.

For heavy construction hauling, excavation work, off-the-road service—for the kind of work your trucks do—Goodyear builds the Dump Truck All-Weather. Examine it. See how it's built to do your work better.

Notice those deep-cut diamond blocks of the All-Weather tread. There's traction. There's pulling-power.

See how that tread design extends down

the sidewalls. Those tough bars of rubber give added traction in ruts—protection from cutting and scraping on sharp rocks and rough surfaces.

Underneath that tread is a body of Super-twist cord—the strongest, most durable cord ever developed for truck tires.

Look at that new, patented, extra-strong bead construction. Heavy, swaying loads on rough ground won't cause that bead to fail.

Goodyear Dump Truck Tires are built for your trucks. They're built to do your work better, longer—more economically. They're built to be **MONEY SAVERS**.

THE GOODYEAR TIRE & RUBBER CO., INC., AKRON, OHIO

CALL THIS MAN

He is the Goodyear Truck Tire Man. He represents the most complete line of truck tires made. Behind him are all the years of Goodyear's experience in the design and application of truck tires for every type of business—for every job. He'll pick the **RIGHT** tires for your trucks. His services cost you nothing. He'll save you money.

SEE THIS TIRE

It's the famous Goodyear Dump Truck All-Weather. It's the most scientifically designed tire built for dump truck work. It represents years of experience in tire building by the world's largest builder of truck tires. It's a **MONEY SAVER**.



money savers

GOODYEAR TRUCK TIRES

Big **CAPACITY** *Plus Portability*

ARE THE LIFE AND PROFITS OF THIS BUSINESS



So if you want to make a showing in the
aggregate field, you too, must have
CAPACITY and PORTABILITY
IN YOUR PLANT

You will get more in any type of a
CEDAR RAPIDS PLANT

"THE IOWA MANUFACTURING LINE"

More **CAPACITY** *Greater* **PORTABILITY**

AND LOWER MAINTENANCE COSTS ARE YOURS IN ANY CEDAR RAPIDS PLANT YOU BUY



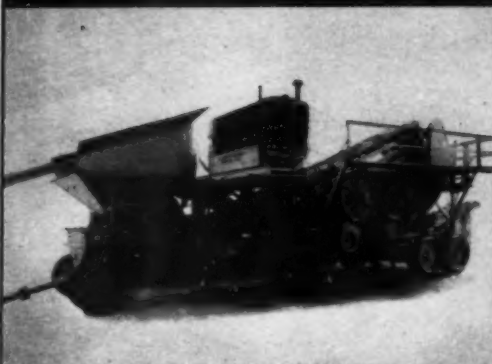
CEDAR RAPIDS STONE SIZING PLANT

WHATEVER YOUR REQUIREMENTS MAY BE IN THE MATERIAL PRODUCING OR HANDLING FIELD. YOU WILL ALWAYS FIND A CEDAR RAPIDS PLANT THAT WILL DO A BETTER JOB.

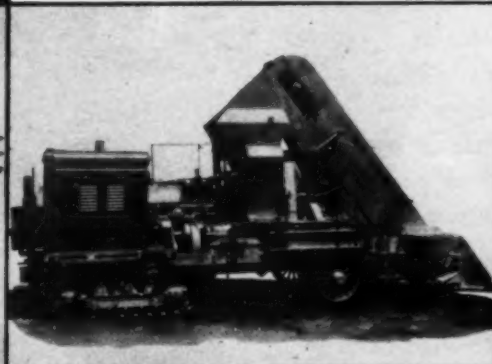
ASK FOR OUR CATALOGS AND BULLETINS BEFORE BUYING YOUR EQUIPMENT.



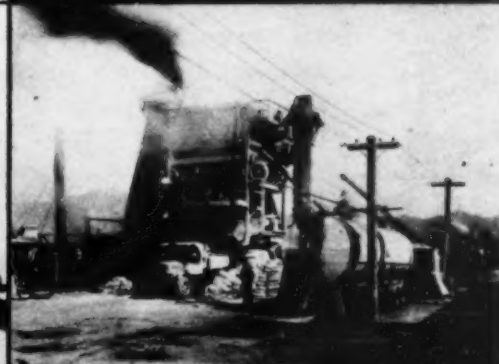
CEDAR RAPIDS JAW CRUSHER



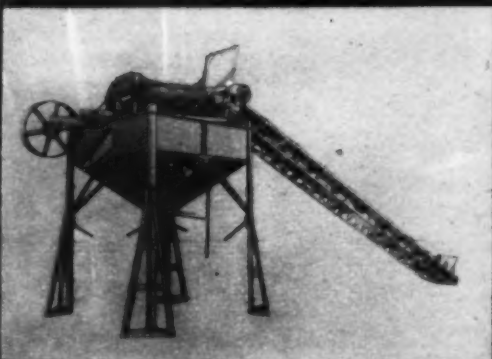
TANDEM STRAIGHT LINE PLANT WITH DIESEL POWER



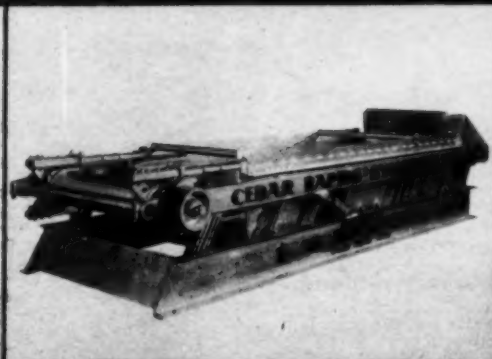
TRAVELING ROAD MIX PLANT



STANDARD CEDAR RAPIDS ASPHALT PAVING PLANTS



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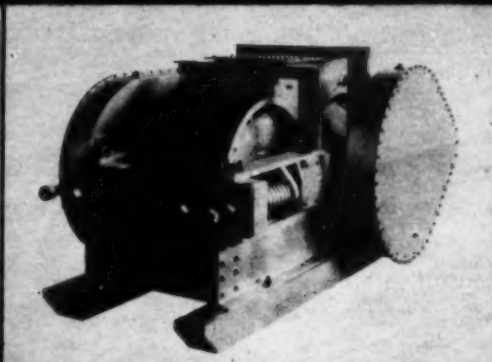
CEDAR RAPIDS SYMONS VIBRATOR SCREEN



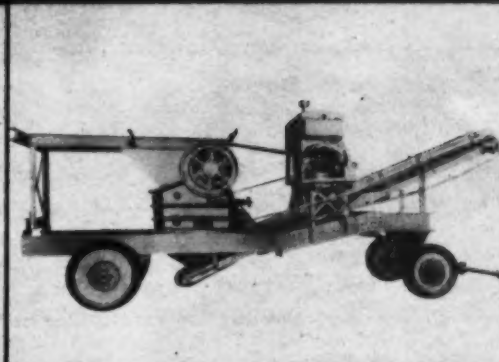
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IOWA MANUFACTURING COMPANY

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A POINT

worth

thinking about

The photograph focuses attention on an important advantage of I-Beam-Lok bridge flooring. The conservative design of I-Beam-Lok provides close spacing of main beams and transverse bars. The small rectangular spaces formed and the strength of the main beams permit the safe operation of trucks and concrete mixers on the unfilled units as soon as they are attached to bridge stringers. This eliminates the need for temporary floors or planking for delivering concrete and materials to the job.

Your finished installation is an armored concrete, anti-skid, long-life wearing surface, free from possibility of the progressive development of large surface cracks. Investigate the many advantages of I-Beam-Lok. Consult with our engineers or send today for descriptive literature.

326

CARNEGIE STEEL COMPANY PITTSBURGH

Pacific Coast Representatives • COLUMBIA STEEL COMPANY • San Francisco, California

United States Steel  *Corporation Subsidiaries*



Announcing

The **SON** of the **FATHER** of Shovels

Back in 1905, the American Hoist & Derrick Co. built the father of all our shovels. Today the latest arrival is the new $\frac{1}{2}$ -yard American Gopher Shovel-Crane-Dragline, and a mighty husky son it is!

In all these years of making and perfecting shovels, it's only natural that we have "soaked up" the engineering and manufacturing knowledge that creates *successful shovels*.

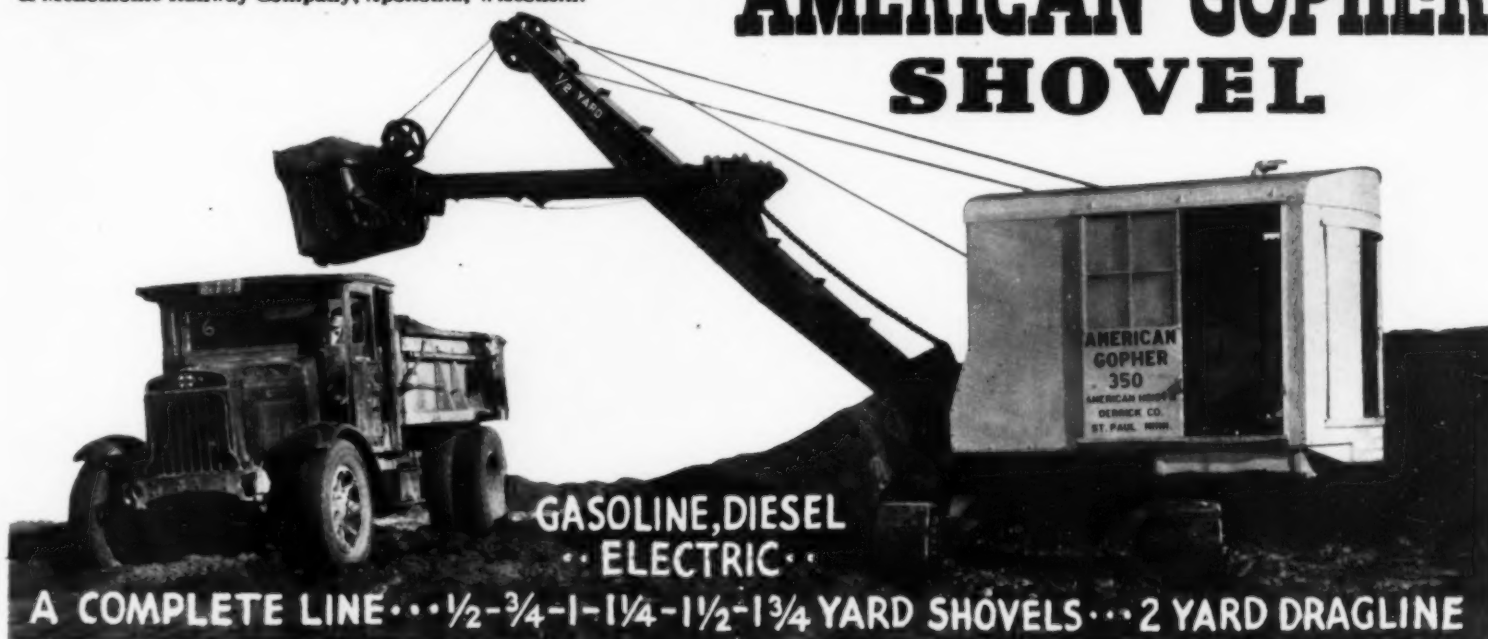
For greater line pulls, larger capacities, faster speed, less weight and low operating costs we invite investigation and comparison.

Send for detailed information on



American Ditcher Shovel, first shovel type machine manufactured, built in 1905. Machine steam operated. Owned by Chippewa River & Menomonic Railway Company, Apollonia, Wisconsin.

THE **NEW** $\frac{1}{2}$ YARD **AMERICAN GOPHER SHOVEL**



THE NEW AMERICAN BULLDOZER—will be ready in 30 days. Place no order until you have seen this latest and greatest of bulldozers. For tractors 35 H. P. and upward—gasoline, Diesel, standard or wide tread.

DISTRIBUTORS—in line with our new policy, we offer our complete line of Shovels and other equipment thru reliable distributors. Write at once for details about open territory.

American Hoist & Derrick Co.

Saint Paul, Minnesota

SHOVELS • CRANES • DRAGLINES • HOISTS • DERRICKS • PILE DRIVERS
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IF YOU'RE USING MODERN METHODS YOU NEED ATHEY FORGED-TRAK TWO-WAY DUMP TRAILERS

● Why let hauling equipment be the "bottle-neck" that cuts down your profits? Athey Forged-Trak Two-Way Dump Trailers are built for TODAY'S jobs. Because of their greater capacity, they take full advantage of modern tractor efficiency. Because they are easier to spot, load, and dump, they

speed up your work. Because their Athey Forged-Trak Wheels carry them over any kind of ground—in any weather—you are assured of *continuous, economical operation*. Whether you use them singly or in train, Athey Forged-Trak Two-Way Dump Trailers mean *lower hauling cost*.

ATHEY TRUSS WHEEL CO., CHICAGO, ILLINOIS
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Cable Address "Trusswheel" Chicago

Dump to right or left—
Side gate down fold
the first 18° of the 53°
dumping angle.

Exceptionally low load-
ing height reduces load-
ing time to minimum.

All-purpose—well
adapted to hauling
sand, earth or rock.

Equipped with the fa-
mous Forged-Trak
wheels—lighter run-
ning, non-clogging,
longer lasting.



ATHEY Forged-Trak

REG. TRADE MARK

Athey Forged-Trak Two-Way Dump Trailers at Grand Coulee Dam. These trailers are furnished in two capacities—10 yds. and 13 yds. rounded load. In train, 20 yds. and 26 yds.

KOPPERS PRODUCTS PROTECT

1. WHY SHOULD ROADS BE SLIPPERY?

For years, Koppers has been pointing out the menace of slippery road surfaces, and the possibility of avoiding this danger through the construction of tar road surfaces. Koppers ads and bulletins like those shown to the right have been issued with that message.



2. GENERAL MOTORS SAYS: General Motors has just published in leading magazines this double page advertisement *left* pointing out that the money and ingenuity it puts into automobiles to add to the safety of the passengers can be completely lost if the driver is careless... *or the road is dangerous.*

3. THE NATIONAL SAFETY COUNCIL SAYS: This year for the third successive time, the National Safety Council has named Milwaukee the safest city in America. Milwaukee has more tar streets than perhaps any other city in America. The map shows its 234 miles of tar-surfaced streets.



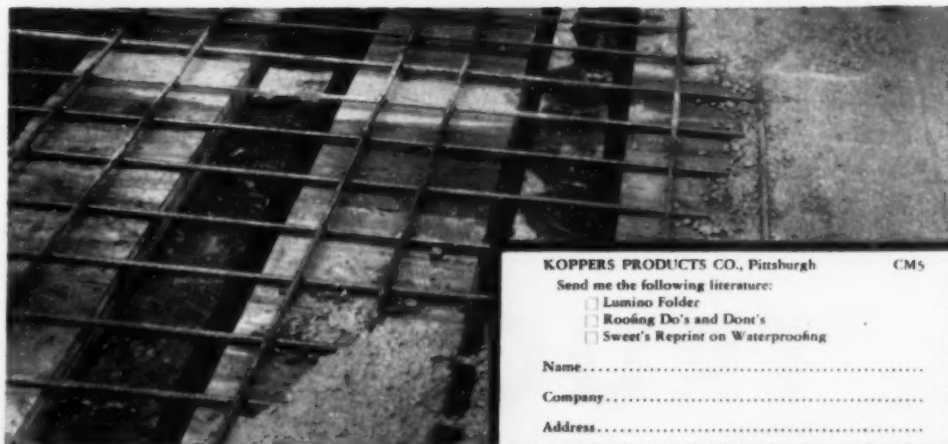
WHY DO SOME ROOFS LAST LONGER THAN OTHERS?

The photo *above* shows a roof of coal tar pitch and felt on a building in Brooklyn, N. Y., which has been in constant service for 16 years without failure. The photo *right* shows a roof (NOT tar) on a building almost adjoining the one shown above. Although these two roofs faced almost identical climatic conditions, the one at the right failed and had to be removed after seven years. It was replaced by a roof of coal tar pitch and felt. Insist that coal tar pitch roofings be used on any roof you buy for a flat deck.



FOR STEEL TO BE EMBEDDED IN CONCRETE:

Ordinary paints are often unsuited for steel which is to be embedded in concrete. Alkalis in the concrete may destroy the paint base; or moisture may cause rust which destroys the paint. Disintegration of the concrete often follows. This problem has been solved with the use of Koppers Redox, No. 20, A.S.O., followed by Koppers Koppax Paint. Write for further information about Redox and Koppax. This photo shows concrete being poured around steel girders which are protected against corrosion.



KOPPERS PRODUCTS COMPANY
KOPPERS BUILDING • PITTSBURGH, PENNA.

Tarmac... Lumino, Tar-Base Aluminum Paint... Old Style Roofing Pitch
Tarred Roofing Felt... Creosote... Waterproofing... Dampproofing

KOPPERS PRODUCTS CO., Pittsburgh CMS
Send me the following literature:
☐ Lumino Folder
☐ Roofing Do's and Don'ts
☐ Sweet's Reprint on Waterproofing
Name.....
Company.....
Address.....



The best proof of their quality
is the money they save you in
HAULAGE COSTS



Put Chevrolet six-cylinder trucks on the job and you can be sure you will get low operating costs! Chevrolet quality manufacture stands squarely behind this statement of fact. Examine a Chevrolet truck—from husky rear axle to efficient cooling system—and you will find quality materials and precision

construction in every part. The result is vital savings for you—*fuel savings* from the famous Blue-Flame valve-in-head truck engine, and *maintenance savings* from the rugged chassis. You have every reason to register *more* payload hours—and *more profitable* payload hours—when Chevrolet trucks go to work for you!

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

Compare Chevrolet's low delivered prices and easy G.M.A.C. terms. A General Motors Value

WORLD'S LOWEST-PRICED TRUCKS

**CHEVROLET
TRUCKS**

FREE! Mail coupon for

"OWNER'S SIMPLIFIED OPERATING RECORD"

Chevrolet Motor Company (Dept. 21A)
Detroit, Michigan

Gentlemen: Without obligation on my part, send me the "Owner's Simplified Operating Record" booklet which enables truck owners to learn operating costs quickly and accurately.

Name and title _____

Company _____

Address _____



State Highway Department installs Armco Metal Cribwall ON ROAD STRAIGHTENING JOB



*Installing ARMCO Metal
Cribwall next to river.
Length, over 400 ft.;
maximum height, 23 ft.*

TAKING the kink out of a highway and at the same time widening it was the problem of this highway department. But protecting the new road against encroachment of the river was necessary.

A study of various materials suitable for this purpose led to the selection of ARMCO Metal Cribbing. It was installed in the winter and early spring. High water from the river stopped operations for days at a time, but without damage to the cribwall.

Each time, work was promptly resumed. The wall was easily put together and it promises to give long, satisfactory service for this condition.

Whenever you have a retaining wall problem, just call in an ARMCO engineer. Without obligation, he will gladly explain the economy of ARMCO Metal Cribbing. Clip and mail the coupon for quick action.

ARMCO CULVERT MFRS. ASSOCIATION
Middletown, Ohio

—ARMCO
METAL CRIBBING

For retaining walls

CONSTRUCTION METHODS—May, 1935



- ☐ Please send me your latest free booklet on ARMCO Metal Cribbing.
☐ I am interested in a wall.....ft. long by.....ft. high.

Name.....
Title.....
Street.....
City..... C.M.S.

BEHEMOTH, TAKE A BOW!



TOLEDO III

Owned by M. A. Breymann. Operates a 17-yard bucket for hard digging—a 28-yard bucket for soft digging. 150 feet in length—55-foot beam—12 feet from deck to bottom. Boom 85 feet long—10-foot boom sheave. Has largest main hoist rope ever built for this type of equipment!



BEHOLD the "Big Bertha" of dipper dredges—the mightiest dredge ever to dip below the waters of the earth. Operating under 50 feet of water through the steel muscles of American Steel & Wire Company Tiger Brand Wire Rope—it loads a 1500 yard scow in practically two hours—and doesn't even work a "sweat" up about it. When it came to selecting the right wire rope to engineer this giant—naturally the owners of this largest Dipper Dredge in the world turned to the builders of the largest selling wire rope in the world—Tiger Brand Wire Rope. Wherever dredges dip, derricks swing and weights suspend, you'll find this safer—more dependable—more economical wire rope operating in the thick of things. Facts—and full cooperation—await your inquiry.

**LARGEST DIPPER DREDGE
IN THE WORLD CHOOSES**

TIGER BRAND

REG. U. S. PAT. OFF.

WIRE ROPE



AMERICAN STEEL & WIRE COMPANY

208 S. LA SALLE STREET, CHICAGO

EMPIRE STATE BUILDING, NEW YORK

Pacific Coast Distributors:

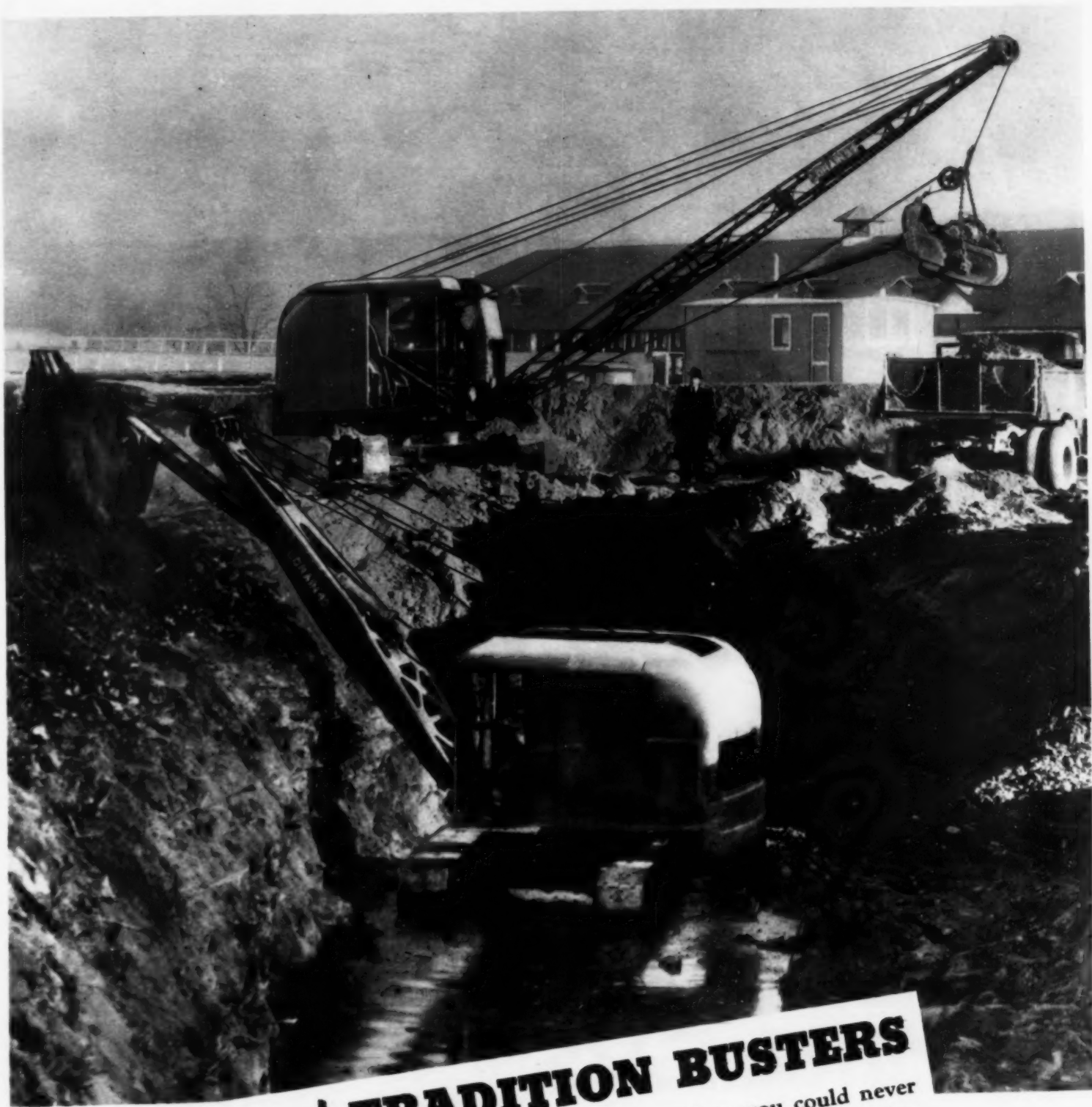
Offices in All Principal Cities

Export Distributors:

Columbia Steel Company, Russ Building, San Francisco


United States Steel Products Company, New York

United States Steel  *Corporation Subsidiary*



THEORY and TRADITION BUSTERS

• If They engineers had been restricted by traditions you could never enjoy the profitable performance of units like L-40-37-30's...abandoning old theories, these units are built on the new principle of shovel and crane design that Capacities depend on Stability and Strength, not Weight... the L-40 is the result, today a tested, proved $\frac{3}{4}$ yd. unit at a weight approximating a $\frac{1}{2}$ yd. unit. . . . It cost us money to take out excess weight, but it saves you money. Manufacturing economies are passed on to you as lower prices; gas, frictions and speed are not wasted running and swinging needless machinery, excess weight.... Write for bulletins, today, telling all about these modern BIG little units in $\frac{3}{4}$, $\frac{5}{8}$ and $\frac{1}{2}$ yard capacities.

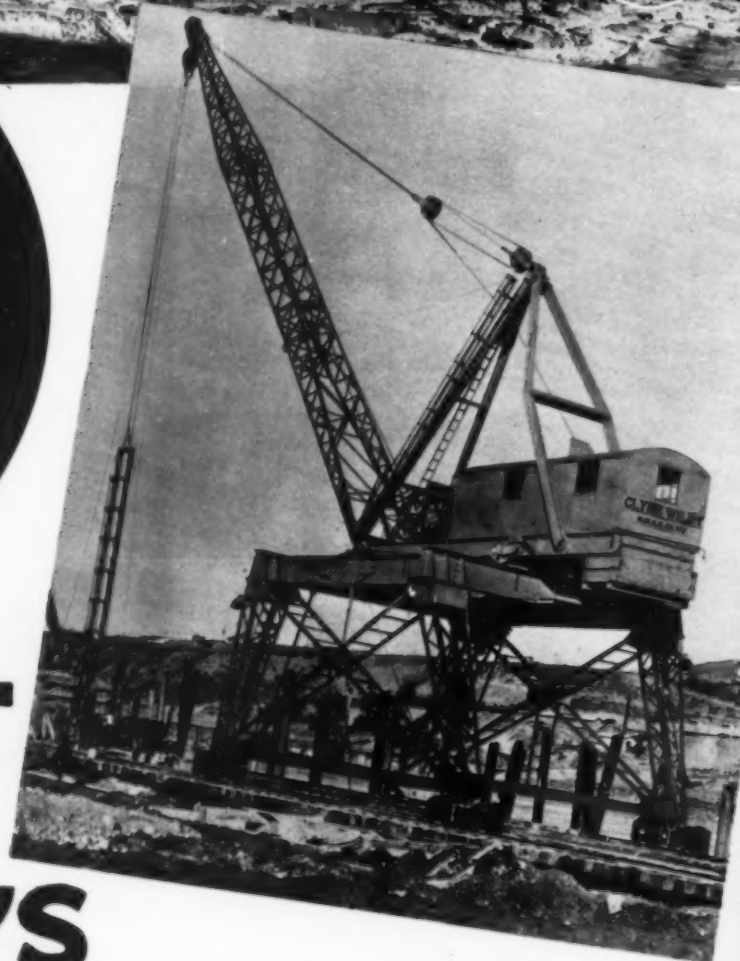
Universal 

LORAIN • 40 • 37 • 30

THE UNIVERSAL CRANE COMPANY, LORAIN, OHIO



CLYDE WILEY - WHIRLEYS



Mason-Walsh-Atkinson-Kier Company are using four of these electric powered Clyde Wiley-Whirleys with 110' booms for helping to build the world's largest cofferdam at Grand Coulee.

Outstanding in appearance as well as in performance, these giant helpers at Grand Coulee dam; and also at the Wheeler dam, Mississippi River dam No. 16, are all exemplary of the skill and care that goes into every Clyde unit. A quarter of a century of experience in designing and building hoists and derricks to meet the needs of the construction world are behind every model bearing the Clyde name. And the manufacturers' pride in their own product is the best guaranty that "You too, will take pride in your Clyde."

CLYDE SALES CO.

DULUTH - MINN.

The New **PLUS** in Road Rolling— **RESERVE PRESSURE**

QUALITY POINT . . .

Within $\frac{1}{8}$ -Inch Surface Variation Under 10-Foot Straight Edge.

PROFIT POINT . . .

Rolling Time 30% to 50% Less—No Cross Rolling.

● The center roll of a Roll-A-Plane is a sentinel placed on guard in the plane of the front and rear rolls, to detect and reduce every irregularity. The diagrams at the right show how it becomes self-actuating after once being lowered into position. The greater the irregularity to be reduced, the greater the force brought to bear at the third pressure point—up to 85% of the machine's weight if necessary. The center roll exerts a negligible force when no high spot appears but concentrates a practically irresistible force in a kneading, compacting, leveling action when an irregularity is met. Its alignment in relation to the other rolls establishes a true plane which is transferred to the surface being rolled.

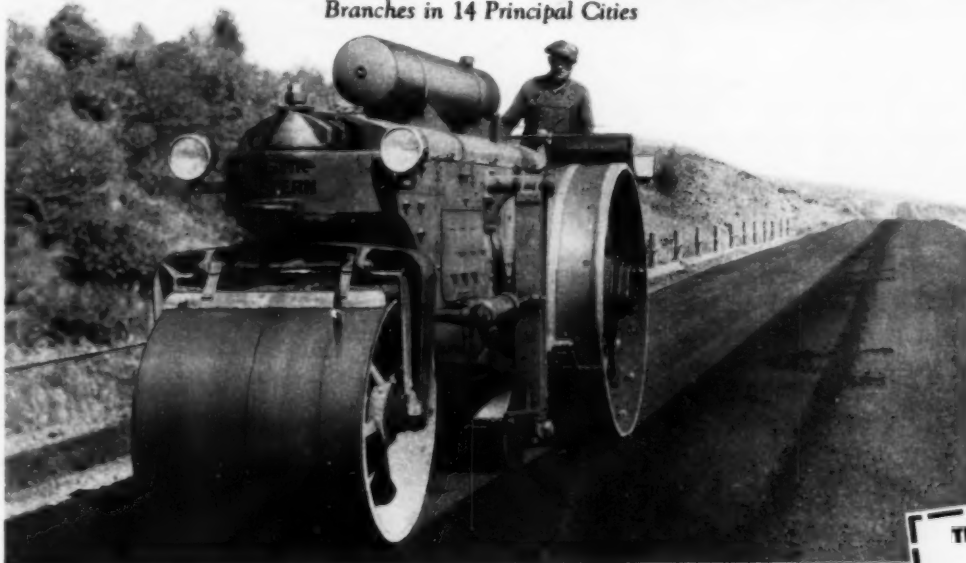
Engineers are discovering new values in the principle as more and more Roll-A-Planes are put into service. Contractors and highway officials are discovering a new conception of levelness and a new low cost for quality roads. The industry is accepting as its standard the Roll-A-Plane, or Austin-Western Rollers on which the Roll-A-Plane feature can be added later. A new booklet now on the press describes the Roll-A-Plane process. Send the coupon.

The Austin-Western Road Machinery Co.

Home Office: Aurora, Illinois

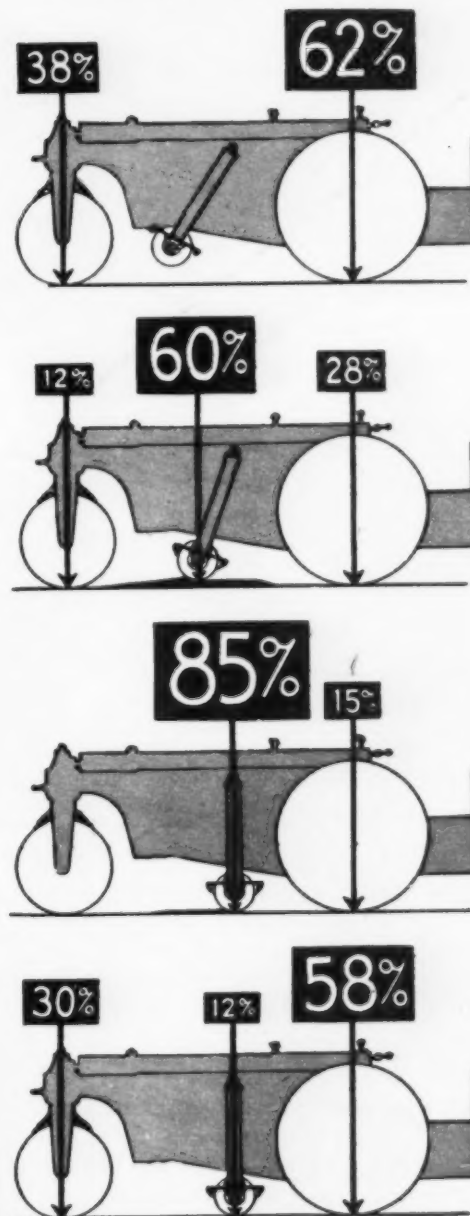
Cable Address: AWCO, Aurora

Branches in 14 Principal Cities



UP TO 85% BROUGHT INTO PLAY AS NEEDED

—Automatic Weight Concentration



ROAD GRADERS • MOTOR GRADERS • ELEVATING GRADERS • DRAGS

Austin-Western

BITUMINOUS DISTRIBUTORS • ROAD-MIX MACHINES • CULVERTS
SCARIFIERS • BULLDOZERS • TRAILERS • SCRAPERS • PLOWS

CRUSHING AND WASHING PLANTS • SWEEPERS AND SPRINKLERS • SHOVELS • CRANES • ETC • SNOW PLOWS

The Austin-Western Road Machinery Co. 405
A-6, Aurora, Illinois

Please furnish ☐ New Booklet.
☐ More details on the Roll-A-Plane.

Name.....
Company.....
Address.....
City..... State.....



DUMP CARS
DUMP WAGONS

NOW REO GUARANTEED PERFORMANCE

in the Lowest Priced Truck Field!



BEFORE you again invest your money in a low-priced truck, see the splendid new Reo 1 1/2 Ton Speedwagon, at the sensational price of \$535, and ask yourself this question:

"Where else can I buy a truck comparable to this new Reo, in power, rugged strength, performance, and speed—*plus the definite assurance of guaranteed performance?*"

The answer is: "Nowhere in the industry!" For, Reo, alone of all truck manufacturers, gives you this definite warranty: *each and every Reo Speedwagon carries an Ability Rating Plate which tells you exactly what performance may be expected—in high gear, on steep hills and over level roads. All trucks operated under this plan are fully guaranteed!*

Backing up this warranty, of course, is traditional Reo truck

quality and the modern engineering you would expect from Reo's 30 years in the truck business.

Go over the new Reo Speedwagon's specifications, point by point. You will find a husky 6-cylinder Silver Crown Truck Engine—Reo-engineered and built; hydraulic brakes, pioneered by Reo for truck use; maximum loading space; balanced load distribution; full floating axle; streamline appearance and comfortable cabs for drivers.

This handsome new Reo Speedwagon will do more than reflect credit on your business—it will credit your good sense in obtaining substantial savings on haulage, in freedom from repair and above all in long life and economy. Call your Reo dealer today and have him explain how you benefit from Reo guaranteed performance.

STANDARD BODY TYPES FOR NEARLY EVERY HAULING NEED



REO 1 1/2 TON OPEN EXPRESS



REO 1/2 TON PICKUP

\$535*

1 1/2 TON SPEEDWAGON CHASSIS

Reo Speedwagons and Trucks range from 1/4 to 4-6 tons including Tractor-Trailers and Buses. Prices from \$495 up, chassis f. o. b. Lansing, plus tax. Special equipment extra.

Prices subject to change without notice.

*Chassis f. o. b. Lansing, tax and dual wheels extra.

REO MOTOR CAR COMPANY
LANSING, MICH.

May, 1935—CONSTRUCTION METHODS

JAEGER *Adjustable* SPREADER

Smoothly Spreads Stone, Macadam and Bituminous - 1" to 7" Thickness, 8 to 11 Ft. Widths

COSTS NO MORE THAN ORDINARY SPREADER BOX!



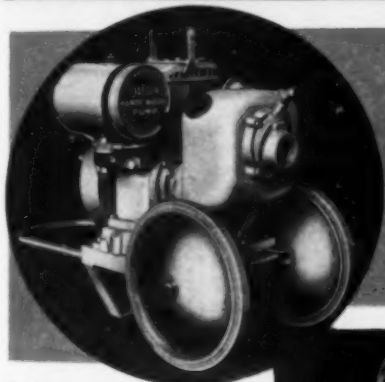
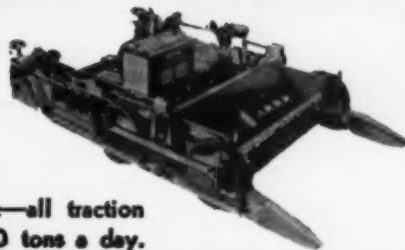
Jaeger Dust Blower



Clears 6-ft. paths, insures perfect bond for black top pavements.

Jaeger Bituminous Paver Power Propelled, Width Adjustable 9 to 15 Ft.

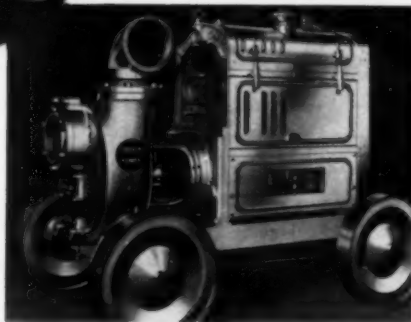
For smooth, precision finished roads, without forms—full floating 18-ft. straight edge runners equalize subgrade—all traction on hard surface. Capacity 400 to 1000 tons a day.



\$11500

\$10 Extra for Rubber Tires buys this 8500 Gal. "Handy Model"

Below: "BANTAM WEIGHT" 8500 Gal. Portable Pump

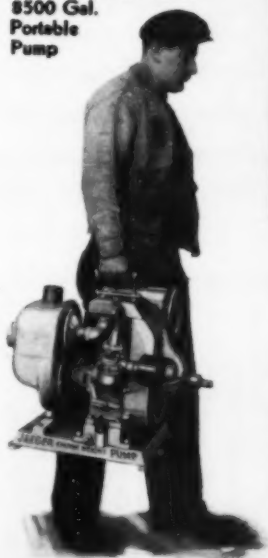


JAEGER "SURE PRIME" PUMPS

(10,000 TO 135,000 GALLONS)

Built in 2", 3", 4", 6" and 8" sizes, Jaeger Heavy Duty Self-Priming Centrifugals are world's largest selling pump of their type for construction jobs, industrial work, public utility and municipal maintenance, etc.

JAEGER WELL POINT SYSTEMS provide "dry job" conditions at lowest known cost. Used on small jobs and biggest. Send for new CATALOG P-35.

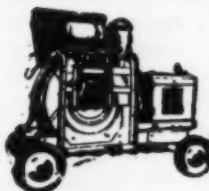


**LOOK
the 10S
SPEED
KING**



Build Your Bridges with this END DISCHARGE 2-BAGGER!

Also built with side discharge, 4 wheels.



Full 2-bag capacity, plus END DISCHARGE, speeds up production and cuts your costs by discharging direct into bridge forms, pouring walks, floors, alleys with swinging spout, saving street space, saving wheelers.

Big brother to the famous Speed King 7S.

WRITE FOR CATALOG N-35 AND NEW LOW PRICES

THE JAEGER MACHINE COMPANY • 800 Dublin Ave., Columbus, Ohio

HOW TO *cheat* THE SCRAP PILE....



... save thousands of dollars

WORN or broken parts of contractors' equipment can be made as good as new, for a fraction of replacement costs, by welding with a "Shield-Arc" welder. With this modern repair tool, worn parts of power shovels, trucks and tractors and other parts can be built up to original size and shape. Parts subject to shock and abrasion can be resurfaced with weld metal which wears better than the original metal. Cracked or broken

castings can be welded whole again. Often the savings from a single repair more than pay for a "Shield-Arc" welder. And you will find hundreds of other uses, such as piping, piling, steel erection and many other applications where the "Shield-Arc" welder can save time and cut costs.

Even the actual welding operation costs less with a "Shield-Arc". It is guaranteed 3-ways to produce more welding per dollar. Find out now how much a "Shield-Arc" welder can save you. Write The Lincoln Electric Co., Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World.



LAD "I see they're tearing down the buildings across the way to save taxes."

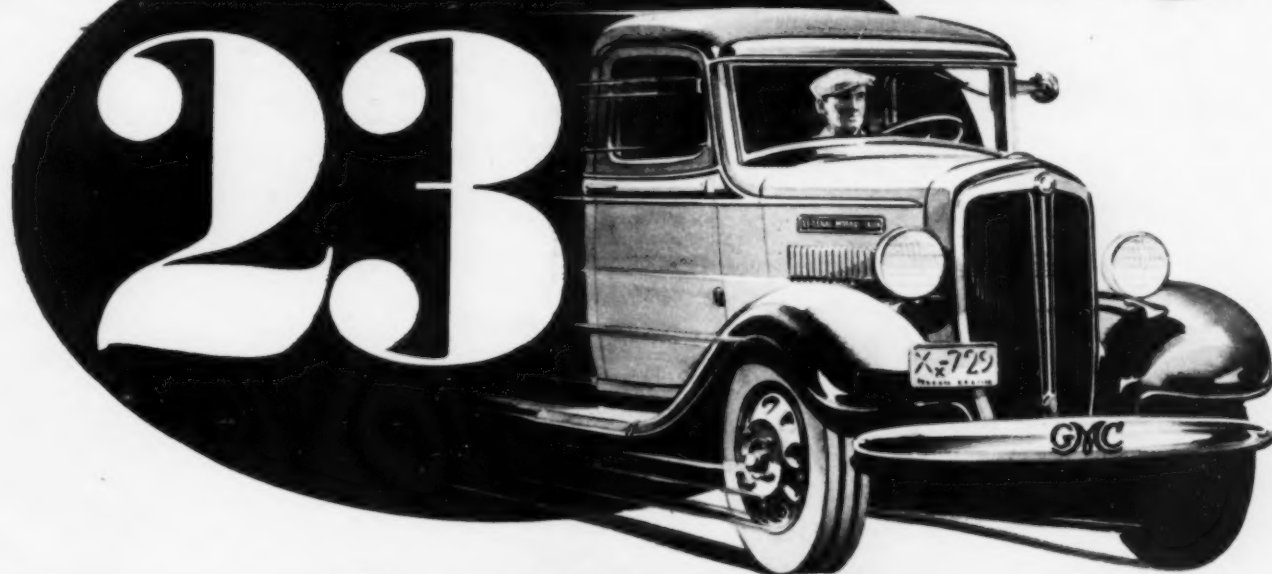
POP "Wrong way round, Lad; someone should be tearing down taxes to save the buildings. Taxes eat up profits almost as fast as breakdowns. Think of the profits we've saved since we bought a 'Shield-Arc'. Just Lincoln electrodes for hard surfacing alone have saved us twice the price of the 'Shield-Arc' welder."

LINCOLN

"SHIELD-ARC" WELDERS

W-122

T H E T R U C K O F V A L U E



Money Saving Features *in its engine alone*

IN ADDITION to more than a score of other important chassis features—many of them exclusive—the quality GMC 1½-2 ton truck has at least 23 engine refinements that reflect themselves in more work done and more profits earned . . . features such as cast nickel alloy iron block and head, *complete* full-pressure lubrication, high sustained torque, 85-pound drop forged counterweighted crankshaft with harmonic balancer, and many others that seasoned truck operators value.

Is it any wonder, then, that shrewd business men the country over are swinging to this many-feature truck? Swinging to the truck that has at least 47 money-saving features . . . that excels each of its chief competitors on many important counts . . . excels on such counts as greater payload capacity, greater horsepower, drop-forged wheels

and latest type Lockheed hydraulic brakes with economical centrifuse drums and exceptionally large quality brake linings.

It will pay any truck buyer to see, test and compare the 1½-2 ton GMC. In fact, no matter what his hauling needs may be, he will find in the 1½ to 22 tons GMC truck and trailer line a unit to fit his needs exactly, a unit of tried-and-proved ability to out-perform and out-earn on any sound basis of comparison.

A Typical Value Fact

The engine of the GMC 1½-2 ton truck develops greater sustained torque than any one of its chief competitors. This means that it will climb steeper grades at faster speeds or pull heavier loads faster—in short, accomplish more work in a given time.

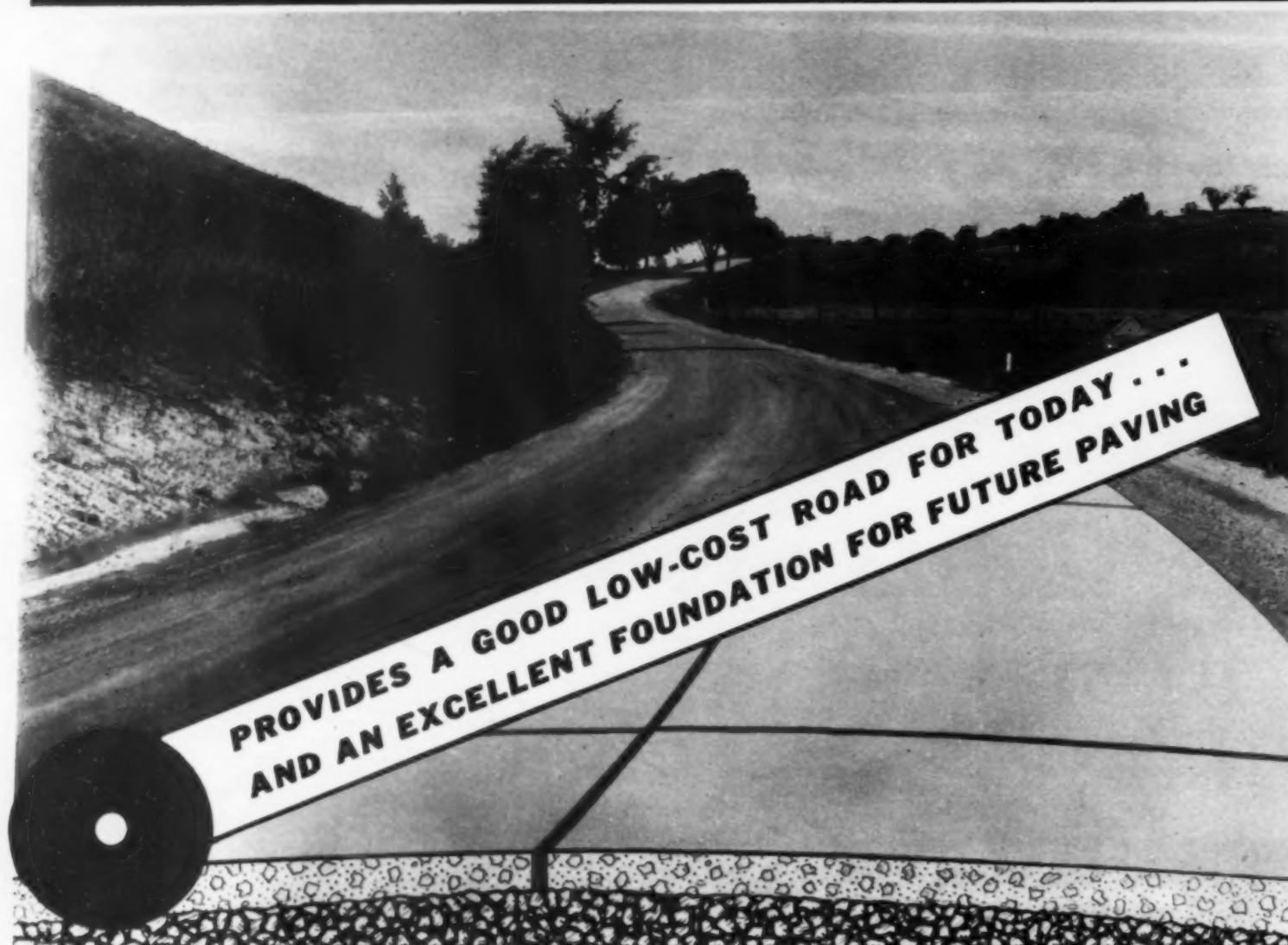
FOR STARTLING PERFORMANCE AND GREATER ECONOMY

See the revolutionary dual performance axle now available in the 2-3 ton range. It provides a high-high gear (5.14 to 1) for fast movement on the level at economical engine speed and a low-high gear (7.15 to 1) which assures improved performance with heavy loads on hills or where the going is hard.

GENERAL MOTORS TRUCKS and TRAILERS
1½-22 TONS

GENERAL MOTORS TRUCK CO. Time Payments Available Through Our Own Y.M.A.C. **PONTIAC, MICHIGAN**
CONSTRUCTION METHODS—May, 1935

Soil Stabilization



CONSIDER "soil stabilized" road surfacing for its immediate advantages alone, and it will prove itself easily the most economical method ever perfected for improving secondary highways and maintaining them in a smooth, hard, dustless condition year after year.

Then consider what an excellent base they make for later pavements when traffic necessitates and funds permit their construction. . . . Think of the advantages and the money and time that will be saved by having foundations already in—and paid for!

The above picture represents a case in point. The stretch of road in a Michigan county has been "soil stabilized". . . surfaced with graded proportions of gravel, sand and loam, bonded by moisture supplied by Calcium Chloride, and compacted by traffic into a hard, smooth, wear-taking mat. Later

—without a lot of further excavating and grading—it will serve as sub-grade for permanent paving.

Thus county highway officials are looking toward the future while at once giving to citizens more miles of good roads than would otherwise be possible. Other communities in many sections of the country are adopting similar programs . . . for "soil stabilized" roads are no longer an experiment. Innumerable field and service tests and the highest kinds of official endorsements support their absolute practicability and economy. Write for literature. Address any of these members of the CALCIUM CHLORIDE ASSOCIATION:

Solvay Sales Corporation 40 Rector St., New York City
The Dew Chemical Company Midland, Michigan
The Columbia Alkali Corporation Barberton, Ohio
Michigan Alkali Company 60 E. 42nd St., New York City

Calcium Chloride for stabilizing road surfaces

Mister! there's a WATER HANDLING PROFIT

with Novo Self-Priming Centrifugal Pumps

And you can figure it out for yourself. If your pumps carry you through your job without a hitch, won't you stand to show a profit due to your pump performance? Here's how you get the performance with Novo Pumps.

Big Rugged Power Units that stand the gaff. The most powerful engine on any self-primer. They develop ample horsepower without excessive speeds.

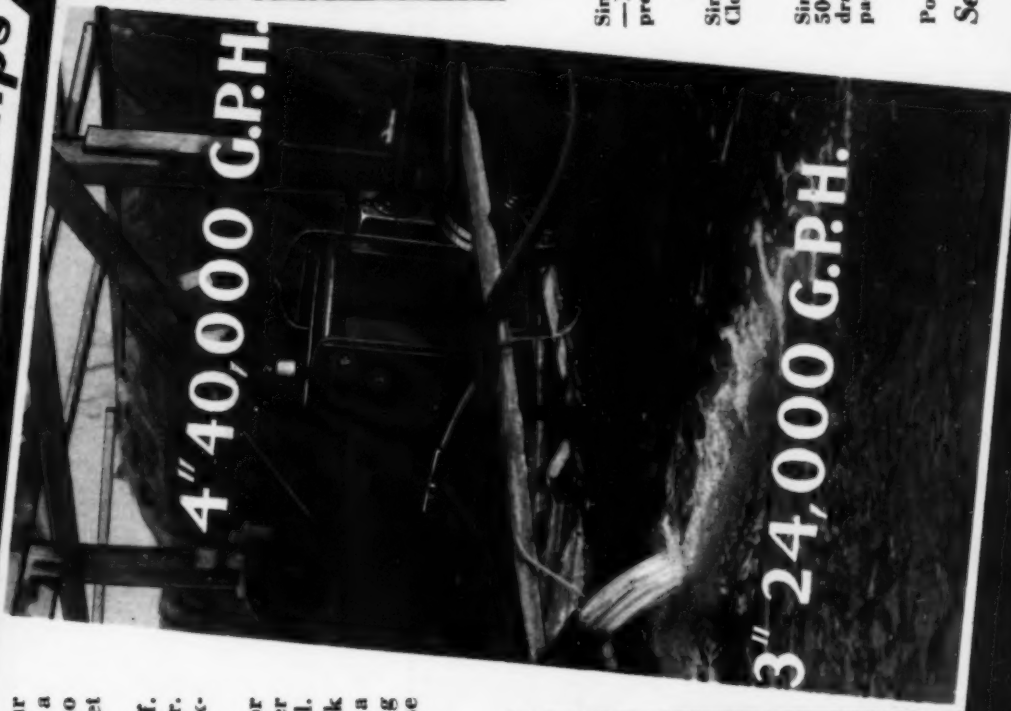
Operates Without Packing.—No time out or maintenance expense for packing. Two leather seals on the impeller shaft make the seal.

Not a Valve in These Pumps.—Can you think of a better way to eliminate trouble than a design without valves. The Novo fast priming and big capacities are secured without the use of valves.

\$115⁰⁰ and up



2" 10,000 G.P.H.



3" 24,000 G.P.H.

4" 40,000 G.P.H.



6" 90,000 G.P.H.

PRESSURE PUMPS

Single and Duplex—Double Acting—15 to 110 GPM—40-450 pounds pressure

DIAPHRAGM PUMPS

Single and Double—Open and Closed Force Models.

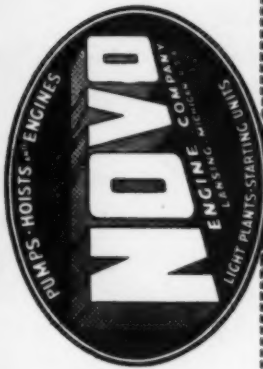
HOISTS

Single, Double and Triple Drum—500 pounds to 7 ton capacity—also dragline up to 2½ cubic yard capacity.

LIGHT PLANTS

Portable for Construction Work.

Send for Coupon
for full information



NOVO ENGINE COMPANY
214 Porter Street, Lansing, Michigan

Send me without obligation information on: Novo

- ☐ Self-Priming Centrifugal Pumps
☐ Pressure Pumps
☐ Diaphragm Pumps
☐ Hoists
☐ Dragline Hoists

**NO TIME WASTED
IN NUT TURNING**

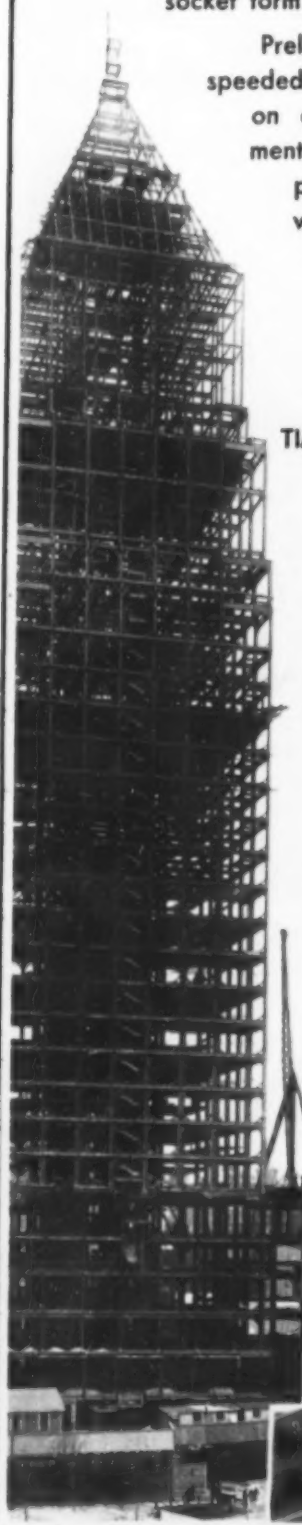
WITH THE
**"FAVORITE"
REVERSIBLE RATCHET
WRENCH**



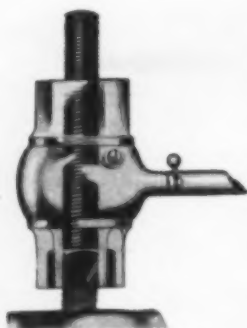
Contractors on large engineering projects have found the "FAVORITE" an invaluable tool in the quick turning of nuts. Time is saved because the wrench does not leave the nut until operation is completed. A turn of the pawl and motion is reversed for loosening the nut.

Nut is encompassed on all sides with socket form of head.

Preliminary bolting operations are speeded up with the "FAVORITE." Works on a straight-ahead ratchet movement and can be used in narrower places than an ordinary open-end wrench.



A
TIME-SAVER



Each head can turn two different-size nuts, one size on each end.

Cadmium finish affords a weather protection.

New metal in Handles, Heads and Pawls makes the "Favorite" stronger for rougher usage.

Send for full particulars.

**GREENE,
TWEED & CO.**
109 Duane Street
New York, N. Y.



A NEW WAY TO RIDE ON RUBBER



SPONGEX

SPONGE RUBBER SEAT CUSHIONS

provide

A cushion for every seat

SADDLE OR BOX TYPE

● Spongex Cushions absorb the severest shock and vibration. The special grid construction makes them the only cushions that will take up the jolts of tractor and road machinery operation. They

greatly reduce driver fatigue.

Spongex Cushions are all sponge rubber construction. They last far longer than spring cushions and give superior riding ease and protection.

Write for full information today.

SPONGE RUBBER PRODUCTS CO.
DERBY, CONNECTICUT

SPONGE RUBBER PRODUCTS CO., Derby, Conn.-

Please send me your booklet, "A New Way to Ride on Rubber."

I am interested in Spongex Cushions for Tractors ☐ Road Machinery ☐ Trucks ☐.

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CONSTRUCTION METHODS

McGRAW-HILL PUBLISHING CO., INC.

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NEW YORK, N. Y.



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Street _____ City and State _____

THESE RATES APPLY ONLY TO THE UNITED STATES AND POSSESSIONS

Road Economy

A MATTER OF GOOD ENGINEERING PLUS GOOD MACHINERY



You are taking care of the first . . . let us serve you in the latter.

Because of its extra quality . . . extra value . . . Galion Road Machinery has been selected by State, County and Township Highway Departments, as well as leading contractors not only in the United States but in practically every country throughout the world.

More convenience . . . more durability . . . greater suitability to the job . . . more efficiency . . . you will find them all in Galion Products.

Galion gives you the best in Road Machinery . . . in fact, the company has developed many of the basic principles found in Road Machinery today. Galion assures you complete satisfaction . . . unequalled service.

Let us send you literature covering the equipment you need.

← GALION MOTOR PATROL

GRADERS Manual or Hydraulic Control. Hydraulic Control enables the operator to cover more road with less fatigue. Offered in combination with four of the leading makes of Tractors.

← GALION LEANING

WHEEL GRADERS Hydraulic or mechanical control. A wide range of sizes and weights to meet every grading requirement. Embody many features of grader construction and operation to assure rugged performance and long life.

GALION STONE AND → ASPHALT SPREADERS

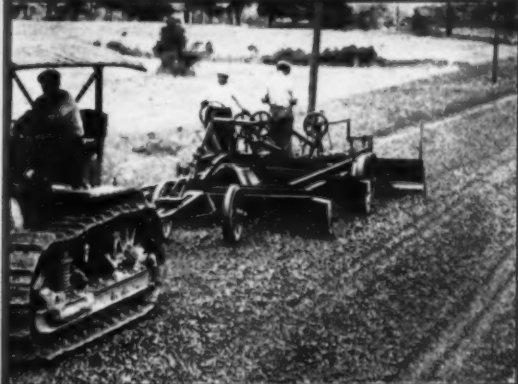
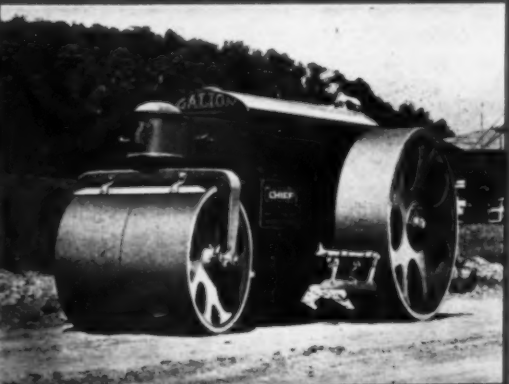
Three types: Stone, Asphalt and Road Widening Spreaders. Built in 8 and 9 ft. widths for use with trucks. A combination of rollers and steel runners facilitates easy movement over hard or soft surfaces.

← GALION ROAD

ROLLERS Two models: the Chief in 10 and 12 tons; the Warrior in 5, 6, 7 and 8 tons. Fully modern in design and construction and amply powered by smooth six cylinder engines. Higher speed and short turning radius are features of both models.

GALION MIXING → AND LEVELING DRAGS

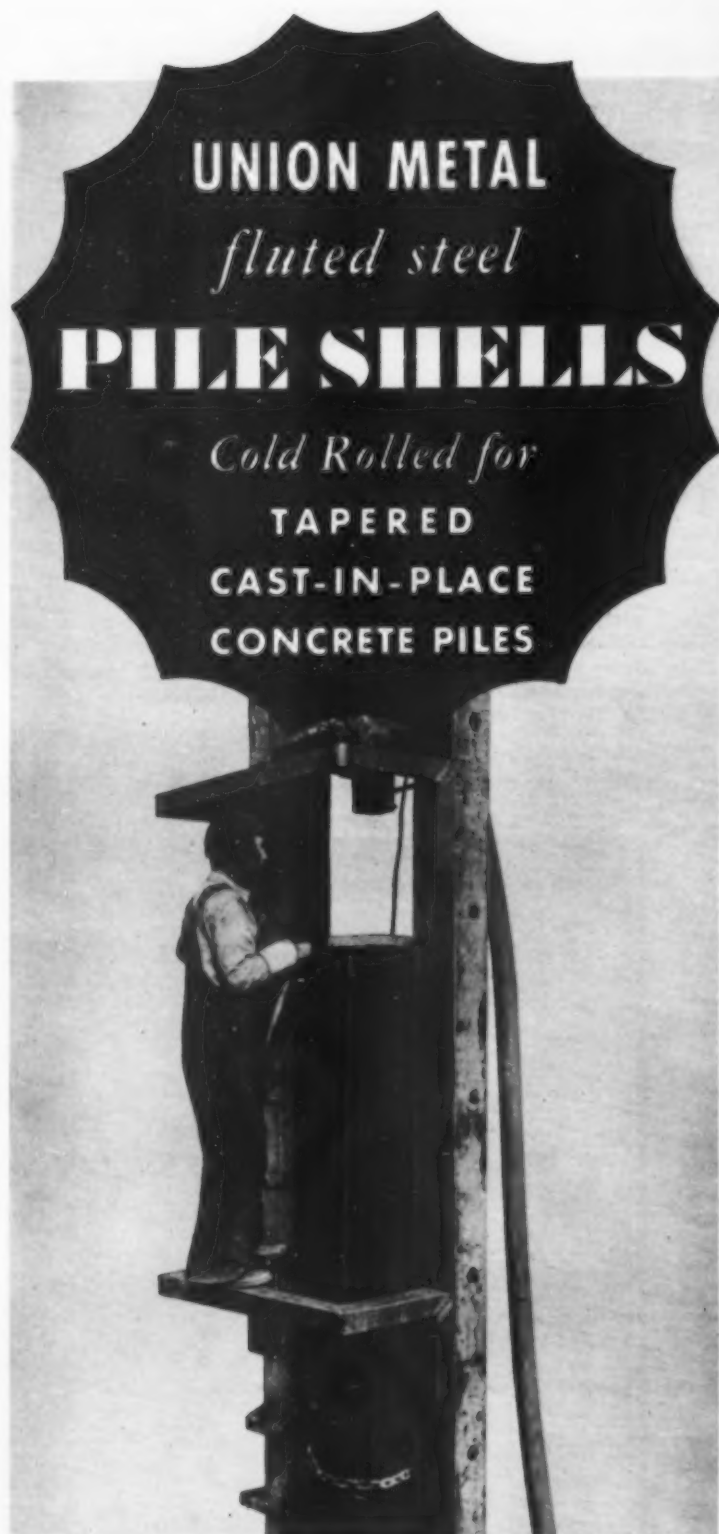
A mixer and leveler combined. The arrangement and shape of its blades accomplishes a thorough mixing of the material and levels it for rolling. A wide range of adjustments is provided by four controls conveniently located.



THE GALION IRON WORKS & MFG. CO., GALION, OHIO

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FLUTED, rigid, strong—Union Metal Steel Pile Shells insure a perfect concrete pile, a better foundation. They are the newest thing in pile shell construction.

Easy to drive, no cores or mandrels required; you can sink five to eight shells an hour. Light in weight, the fluting gives them extra rigidity. HANDLING AND DRIVING COSTS ARE REDUCED. You, too, can save money with these modern pile shells.

All shells are tapered and can be had in various lengths. They suit any job.

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Answers to your problems in structural engineering always at your finger tips

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CM-5-35



-2 BAY CITY Model 62 Diesel 1-Yd. draglines handle *more than half a* *million cubic yards* in less than six months

Three Bay City Model 62 draglines equipped with 50-ft. boom and 1-yd. buckets operating 24 hr. a day, 7 days a week, are writing a dramatic story at Lake Okeechobee. *More than half a million cu.yd. in less than six months*, establishes, we believe, an all-time record for hours operated as well as yardage handled with 1-yd. machines. In July, 1934, three Bay City Model 62 draglines were placed in service for the U. S. Engineers at Clewiston, Fla.

A report, recently issued by the District Engineer's office, covering operation and performance of *two* of these machines from July 23, 1934 to January 18, 1935 (less than six months) is as follows:

"Yardage handled —

Dragline No. 2—296,860 cu.yd. . . 3,200 hr.

Dragline No. 3—226,190 cu.yd. . . 3,429 hr.

*Let
Bay City help
you make
records!*

In addition, dragline No. 3 also dressed 7,000 lineal feet of levee."

It is also unofficially reported that dragline No. 2 during the month of October, excavated in excess of 90,000 cu.yd.—an all-time record for 1-yd. dragline, thus indicating once more that Bay City Shovels with their many outstanding advantages meet every claim for sturdiness, toughness and dependability.

Bay City Shovels, made in nine sizes — $\frac{3}{8}$ yd. to $1\frac{1}{4}$ yd. — will pay for themselves through economy of operation and yardage handled. On *your* next job, whether large or small, investigate the profit-making, cost-saving advantages that have been built into Bay City design. They will help *you* make records too.

BAY CITY SHOVELS Inc. (Eastern Offices, Roselle, N. J.) **BAY CITY, MICH.**

THE MICHIGAN TRUCK SHOVEL

Uniquely designed to meet the great demand for a power shovel that travels rapidly under its own power, the Michigan Truck Shovel offers the contractor and road builder an ideal tool with which he can efficiently handle jobs too large to shovel by hand and too small for a larger and less mobile machine. Speeds up to twenty miles—ready for work at all times—one engine furnishes power for transportation and digging. Write today for new bulletin.

**MICHIGAN POWER
SHOVEL COMPANY**
Benton Harbor Michigan



MICHIGAN SHOVEL
for use on
Highway Maintenance
Fills
Backfilling
Cleaning Slides
Industrial Work
Scrap Material Yards
Lumber Yards
Retail Coal Yards
Basement Excavating
Gravel Pits and Stone
Quarries
Pipe Line Laying

SMOOTH WORK



The Flexible Road Joint Machine Company make finishers for all purposes and in all sizes for both concrete and black top roads. This particular job shows six wheel traction; even eight wheel traction can be furnished should it be necessary.

The forms shown in the picture are made by The Heltzel Steel Form & Iron Company of Warren, Ohio, and are set to line and grade, and with the finishing machine running on them, produces a black top surface just about as smooth as concrete.

Equipment Furnished by —

FLEXIBLE ROAD JOINT MACHINE CO.
Warren, Ohio

QUINN PIPE FORMS

HAND or WET PROCESS

Make concrete pipe on the job with Quinn Pipe Forms. Gives employment AT HOME where it is needed. Quinn Pipe Forms can be handled by less experienced labor and produce uniform concrete pipe of highest quality.

HEAVY DUTY CONCRETE PIPE FORMS

Built to give more years of service—sizes for any diameter pipe from 12 to 84 inches—tongue and groove or bell end pipe—any length. Backed by years of service in the hands of contractors, municipal departments and pipe manufacturers.



NEW MEDIUM DUTY CONCRETE PIPE FORMS

Meet the demand for low cost equipment that produces a uniform quality of pipe in smaller amounts. Complete in every way—Stands up on any job. Same sizes as "Heavy Duty," from 12 to 84 inches—any length.

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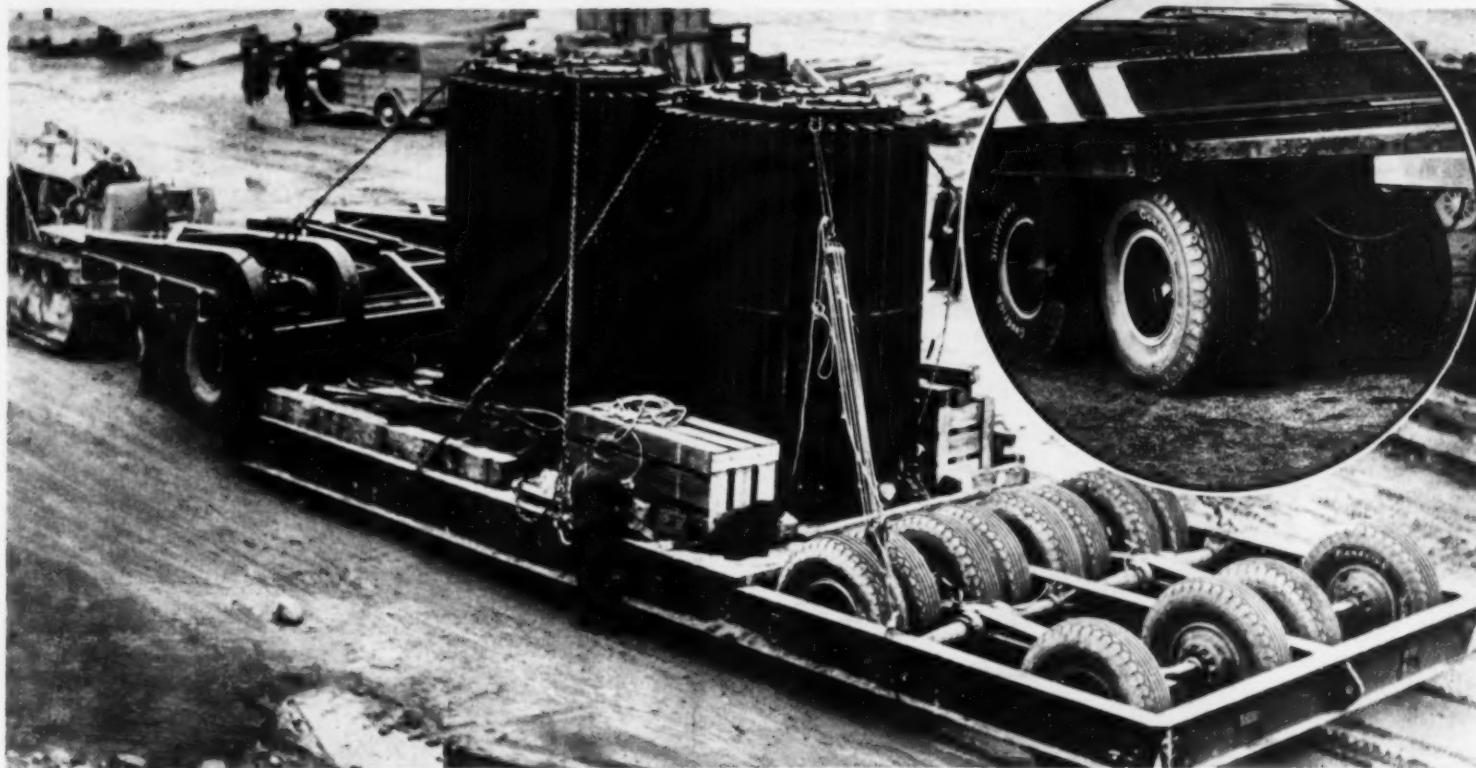
Get complete information on prices and Special Construction features of Quinn Pipe Forms. Give us size of job for estimate on your pipe form needs. Also manufacturers of concrete pipe machines for making pipe by machine process

QUINN WIRE & IRON WORKS

1625 TWELFTH ST.

BOONE, IOWA

80-TON LOADS *Don't Scare These Tires*



NEW TYPE TRUCK TIRES USED ON GIANT 20-WHEEL TRAILER AT GRAND COULEE DAM

They had a tough transportation problem at Grand Coulee Dam. Heavy equipment and materials had to be hauled 30 miles or more over rough roads to the site of the dam. It takes a crawler tractor to supply the power!

So the contractor built what is believed to be the world's largest trailer. Built for loads up to 60 tons. The trailer itself weighs 20 tons.

To carry this gigantic load they use the new Triple Protected Silvertowns—the tires that have proved themselves on the hardest hauling jobs in the country!

These new truck tires have a revolutionary invention incorporated in the sidewall. The invention actually checks 80% of premature failures. It means that tires stand up longer

under the battering, bruising punishment of construction work.

Tires that carry 80-ton loads at Grand Coulee will handle *your* job right, too! One tire failure on an important job may cost you hours of delay—men and equipment idle—a big repair bill. Why not play safe? Get the tire that's just as strong in the sidewall as it is under the tread! Here's how triple protection works:

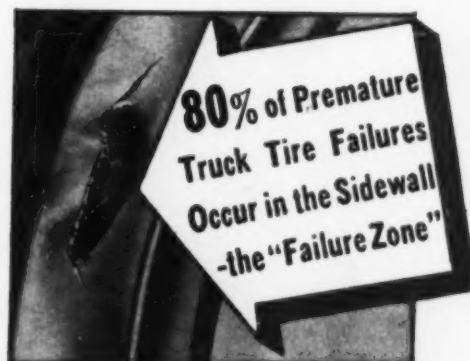
1 PLYFLEX—a new, tough, sturdy rubber material with greater resistance to stretch. A layer of Plyflex in the sidewall prevents ply separation—distributes stresses—checks local weakness.

2 PLY-LOCK—the new Goodrich way of locking the plies about the bead. Anchoring them in place. Positive protection against the short plies tearing loose above the bead.

3 100% FULL-FLOATING CORD—Each cord is surrounded by rubber. With ordinary cross-woven fabric, when the cords touch each other, they rub—get hot—break. In Silvertowns, there are no cross cords. No friction.

FREE! 44-PAGE HANDBOOK FOR TRUCK OPERATORS

Every truck owner, every driver should have this big 44-page handbook. Gives commodity weights, tire load capacities, inflation schedules, dual spacing chart, load analysis and other useful information. No obligation. Write for free copy. Dept. T-44, The B.F. Goodrich Company, Akron, Ohio.



80% of Premature Truck Tire Failures Occur in the Sidewall—the "Failure Zone"



Only GOODRICH Offers This 3-Way Sidewall Protection—
1. Plyflex 2. Ply-lock
3. Full Floating Cord

Goodrich *Triple Protected* Silvertowns

SPECIFY THESE NEW SILVERTOWN TIRES FOR TRUCKS AND BUSES.



RED EDGE

MADE of the finest Chrome Nickel Alloy Steel procurable, lighter and trimmer, yet tougher than ever, Red Edge is the largest selling high grade shovel in America.

For years this famous brand has been a consistent repeater with the Buyer, for "Red Edge costs less because it lasts longer."

And with the shoveler it is a great favorite because it makes shoveling easier. There are expert shovelers who wouldn't think of using any shovel, spade or scoop that didn't have the familiar Red Edge.

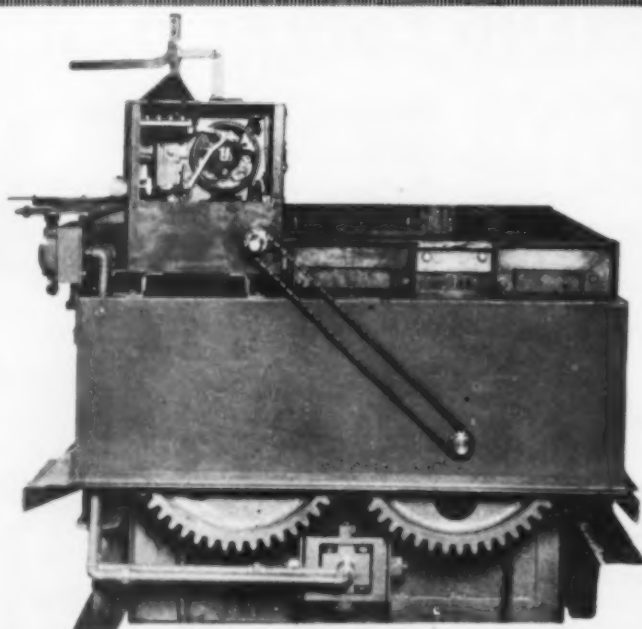
Every Red Edge Dealer knows the merchandising value of that Red Edge—it's a mark of Highest Quality.

ASK YOUR JOBBER

AMES BALDWIN WYOMING CO.

Parkersburg, W. Va.

North Easton, Mass.



MIXING TIME LOCKING DEVICE

For asphalt mixers—Mechanically operated—
Meets State Highway specifications—Applicable to any plant—Many now in operation—

Send for Bulletin T-12

HETHERINGTON & BERNER, Inc.
INDIANAPOLIS, INDIANA

Builders of Asphalt Paving Machinery for over thirty years

NOW...

**A PORTABLE 3" PUMP
THAT WEIGHS ONLY 93 LBS.
and handles 15,000 gal. per hour**

Thousands of builders and contractors all over the world are finding it profitable to avoid delays and speed construction with Homelite Portable Pumps.

Homelite's new portable, self-priming, centrifugal pump weighs only 93 pounds complete with a built-in gasoline engine. One man can easily carry it wherever needed. Rugged in construction. Pumps 15,000 gallons per hour. Built to handle muddy water with solids. Guaranteed 28 foot suction lift. Starts instantly. Self-priming. Will not overheat or freeze; entirely weatherproof.

Write today for descriptive bulletins.

HOMELITE Corporation

55 Riverdale Avenue, Port Chester, N.Y., U.S.A.

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Please send me bulletins describing Homelite Portable Pumps.

Mr. _____

Company _____

Street _____

City _____

State _____





WHEREVER **LETOURNEAU** EQUIPMENT IS USED...

... down go costs. The two jobs pictured are typical.

On the Colorado River Aqueduct (left) a LeTourneau Angledozer takes the rough and rocky going in stride, moves big yardages, cuts costs for Griffith Co. Also working for Griffith Co., are two LeTourneau 30-Yard Buggies and two LeTourneau Bulldozers.

On the Jack Rabbit Trail (below) Crow Bros. use thirty LeTourneau Units. Six Carryall Scrapers, working tandem as pictured here, deliver 65 cubic yards per hour per tandem unit on a 4,000-foot round trip, over grades as steep as 30%, average 11½%. That's moving dirt far and fast! Other LeTourneau Equipment working there includes Bulldozers, Angledozers, Rooters, Sheep's Foot Rollers and Power Units—all big yardage equipment.

Ask our Engineers for Further Information. If you will write us, describing your dirtmoving problems, our Engineers will gladly advise you as to what LeTourneau Units are best fitted to your job.

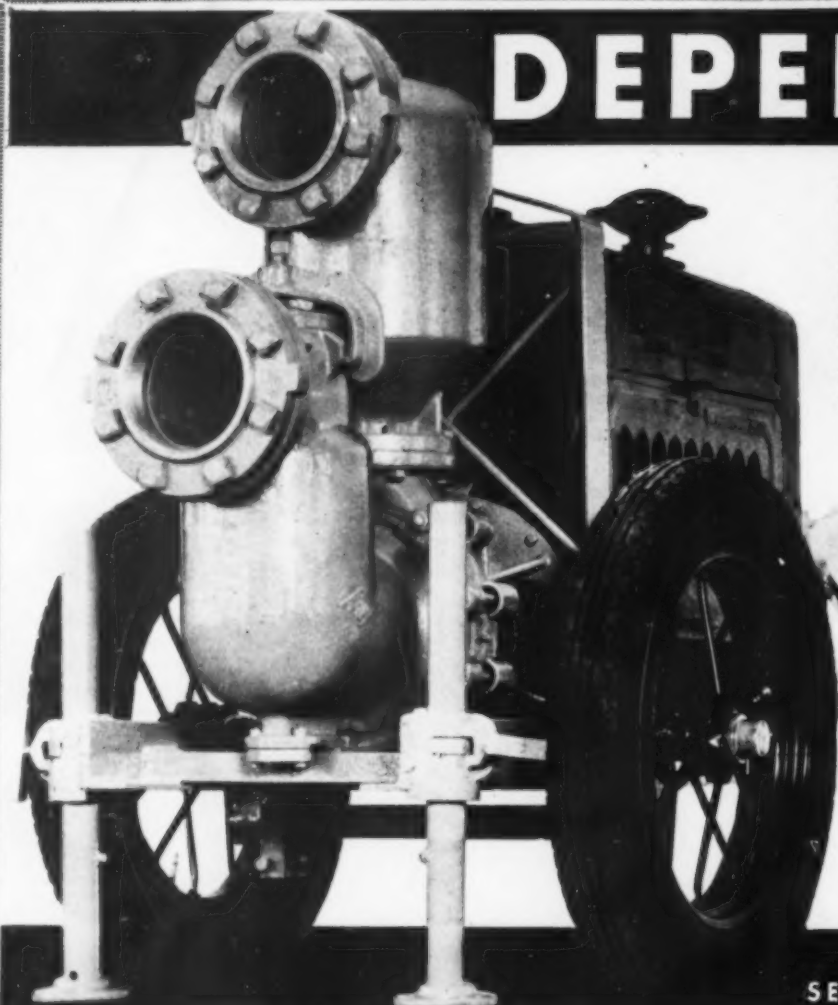
R. G. LETOURNEAU, INC.

PEORIA, ILLINOIS STOCKTON, CALIFORNIA

Cable Address: "Bobletorno"

Manufacturers of: Angledozers, Bulldozers, Buggies, Carryall Scrapers, Derricks, Rooters, Sheep's Foot Rollers, Power Control Units.





DEPENDABLE!

Sturdy strength and mechanical simplicity are combined in LaBour Pumps for contractors' service to make for absolute dependability on the job. There is only one moving part—the impeller. There are no valves or floats to stick or fail to function. Special electric furnace cast iron casings are made with thick walls to withstand indefinite service under conditions in which the water is carrying sand or other abrasives. The impellers are of chrome nickel alloy steel.

Because of its simple construction, a LaBour Pump provides easy accessibility to the working parts. Economical service is assured through honest capacity rating, unexcelled efficiency and careful factory testing of every pump.

LaBour Pumps are made for stationary or portable service, in capacities up to 1500 G.P.M. and may be had for electric motor, turbine, gasoline engine, or belt drive.

Send for a copy of Bulletin 41 which contains full information.

The LaBour Co., Inc.
509 Sterling Avenue
Elkhart, Indiana

**ORIGINATORS OF THE
SELF-PRIMING CENTRIFUGAL PUMP**



Judge them by
PERFORMANCE!


They "have everything" is what users of Baker Bulldozers are saying. Performance counts. Direct lift, perfect smooth control, great strength combined with other brand new features make them the first choice of leading contractors.

Ask For Bulldozer Bulletins

THE BAKER MANUFACTURING CO.
568 Stanford Ave. Springfield, Ill.

TWIN-CYLINDER **BAKER** DIRECT-LIFT
BULLDOZERS

GET THIS FREE PUMP BOOK

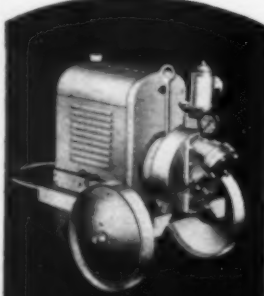


JUST OFF THE PRESS
A combined catalog and handbook of engineering data of great value to every Engineer, Contractor or anyone interested in pumping problems.

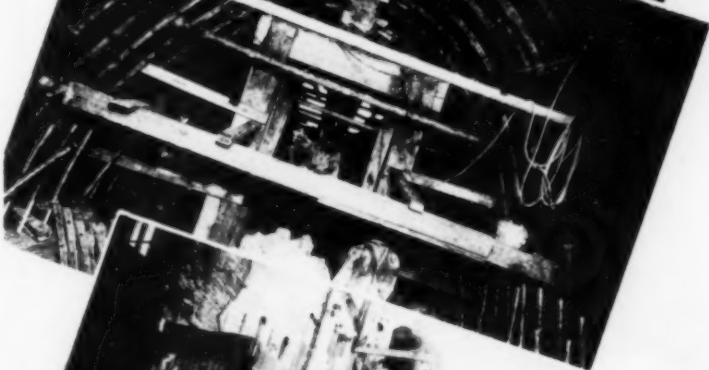
A PUMP FOR EVERY PURPOSE

Regardless of your requirements—there's a Sterling Quality Pump for every job—from the smallest 2" pump to the husky 8" pump designed for big volume work.

Our Engineering Department will gladly offer helpful suggestions without obligation.

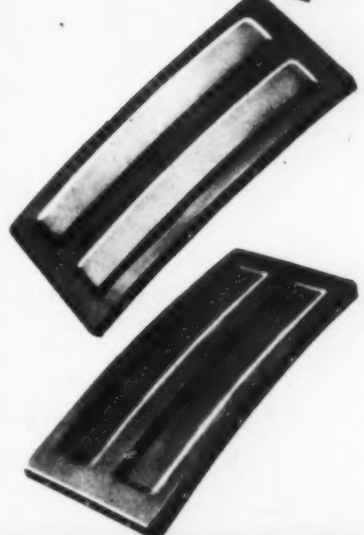


Sterling
MACHINERY CORPORATION
411-13 Southwest Blvd. Kansas City, Mo.



*Speed.
Safety and
economy in*
**UNDERGROUND
CONSTRUCTION**

The use of Truscon steel liner plates for tunnels, shafts and other similar underground construction permits appreciable economies due to savings in excavation and the ease and speed with which the work can be carried forward. They add strength and safety to the structure, preventing cave-ins and loss of headings. Truscon liner plates are accurately formed and assemble to proper shape with a minimum of labor. They can be supplied in various standard contours. Expert tunnel engineering assistance available to all interested without obligation. Illustrated catalog and estimates on request.



TRUSCON STEEL COMPANY

PRESSED STEEL DIVISION

6100 TRUSCON AVENUE

CLEVELAND, OHIO

A young "MOUNTIE"



THE old ordinary wellpoint was made for kitchen use and it may be O. K. for that. But for contractors use—that's a horse of another color.

Just now

a MORETRENCH SYSTEM is bone drying the Coney Island \$1,500,000.00 Disposal Plant. Right alongside is a job where a set of ordinaries broke the contractor.

Just now

a Flushing contractor, who made an "error", switched to MORETRENCH and he writes that "his troubles are over".

Just now

an up-state city, where they monkeyed with a cat and dog system for six weeks without laying a pipe, is going along in MORETRENCH comfort.

Just now

a big river contractor, who was wet last year, is putting in MORETRENCH—will take no more chances.

The best is always the cheapest — and we deal in nothing else.

We want your business on merit alone

MORETRENCH CORPORATION

Works:
Rockaway, New Jersey



Sales Office:
90 West Street, New York City

WATER- PROOFING with

Sika



1 Original surface hacked.



2 Water concentrated to enlarged bleeder holes by Sika #4A.



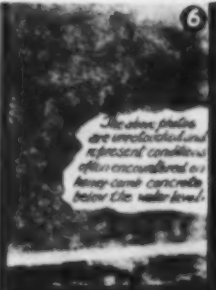
3 Two bleeder holes plugged by Sika #2. Infiltrations concentrated to bleeders.



4 Inserting Sika #2 into last bleeder hole.



5 All bleeder holes plugged with Sika #2, and trimmed to contour.



6 Protective coat of Sika #1 cement plaster applied.

Use Sika

to stop water inflow through any masonry. Sika mixed with portland cement easily applied by hand — seals off infiltration from underground streams even under pressure.

Write us about your problems

Sika, Inc.

1943 Grand Central Terminal
New York City

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BLAW-KNOX COMPANY

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"HEADQUARTERS FOR CONSTRUCTION EQUIPMENT SINCE 1906"

ALL DROP FORGED **ALL ALLOY STEEL** **ALL HEAT TREATED**

These features make

New TRIMO-ALLOY

SAFER · STRONGER
MORE SERVICEABLE

Industry finds in this improved and mightier pipe wrench the real quality leader — made entirely of molybdenum, nickel, chrome and other alloy steel — drop forged and heat treated throughout.

Modernize your pipe wrench equipment with this improved new tool.

TRIMONT MFG. CO., INC.
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TRIMO

TRIMO-ALLOY
PIPE WRENCH

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Any time you need information on equipment or material for which you are in the market—and which you do not find covered in the “Equipment and Materials” directory (see pages 92 and 93) of Construction Methods—by all means let us know.

Our information department will be glad to assist you in securing any information you require, at any time.

Simply address
CONSTRUCTION METHODS

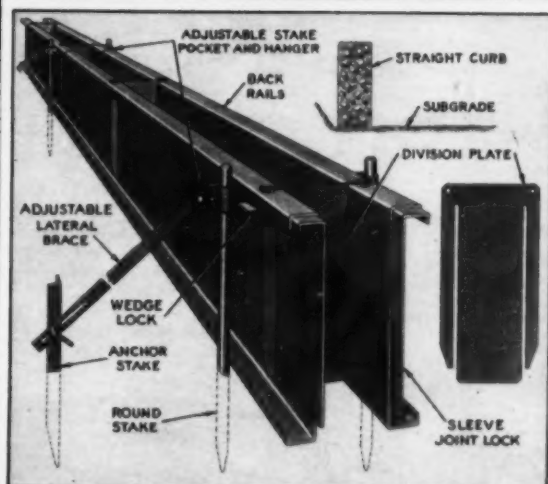
Information Bureau

330 West 42nd Street, New York, N. Y.

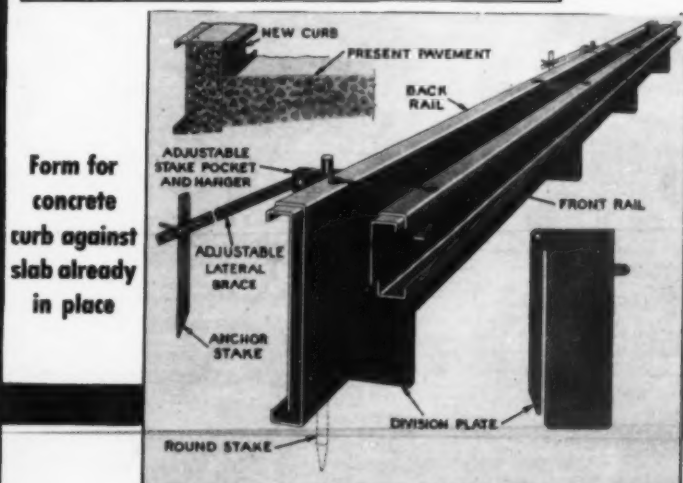
HELTZEL STEEL FORMS



for Curb and Gutter



Form for
straight
concrete
curb



Form for
concrete
curb against
slab already
in place

Write for Bulletin 200—just off press

THE HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO

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An index of products made by manufacturers whose advertisements appear in this issue of Construction Methods.

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Hetherington & Berner, Inc.

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Harnischfeger Corp.
Northwest Engineering Co.

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BELTING
Firestone Tire & Rubber Co.
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Goodyear Tire & Rubber Co.

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Chain Belt Company

BITS, DETACHABLE
Ingersoll-Rand Co.

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International Cement Corp.
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CONCRETE CURING MATERIAL
Calcium Chloride Assn.

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Illinois Steel Co.
Inland Steel Co.
Truscon Steel Co.
Wickwire Spencer Steel Co.

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New York City

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Koehring Company

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Link Belt Co.

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Austin-Western Road Mch. Co.
Bay City Shovels, Inc.
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Link Belt Co.
Michigan Power Shovel Co.
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Universal Crane Co.

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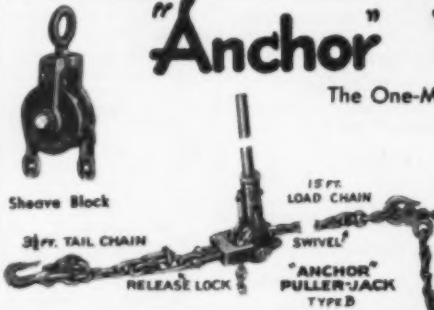
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(Signed) WM. BUXMAN, Manager.

Subscribed to and sworn before me on this 21st day of February, 1935.
(Notary's Seal) **LILLIAN E. BOWEN,** Notary Public.

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Ames Baldwin Wyoming Co.	86
Armco Culvert Mfrs. Assn.	69
Athey Truss Wheel Co.	66
Atlas Powder Co.	24
Austin-Western Road Mch. Co.	27-73
Baker Mfg. Co.	88
Barber-Greene Co.	25
Barrett Company	13
Bay City Shovels, Inc.	83
Blaw-Knox Company	90
Bucyrus-Erie Co.	17
Calcium Chloride Assn.	78
Carnegie Steel Co.	64
Caterpillar Tractor Co.	2nd Cover
Chain Belt Co.	19
Chevrolet Motor Truck Co.	68
Cleveland Tractor Co.	4th Cover
Clyde Sales Company	72
Columbia Alkali Corp.	78
Dow Chemical Co.	78
Du Pont de Nemours Co., Inc., E. I.	12
Edelblute Mfg. Co.	94

Ensign-Bickford Co.	14
Euclid Road Mch. Co.	7
Firestone Tire & Rubber Co.	8
Flexible Road Joint Machine Co.	84
Foot Co., Inc.	18
Fulton Bag & Cotton Mills	94
Galion Iron Wks. and Mfg. Co.	81
General Electric Co.	6
General Motors Truck Co.	77
Goodrich Rubber Co., B. F.	85
Good Roads Mch. Co.	94
Goodyear Tire & Rubber Co.	61
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Hazard Wire Rope Co.	3rd Cover
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Hydrauger Corp., Ltd.	94
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Ingersoll-Rand Co.	5
Inland Steel Co.	60
International Cement Corp.	9
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Jaeger Machine Co.	75

Koehring Company	20
Koppers Products Co.	67
La Bour Company	88
Le Tourneau, R. G.	87
L & M Mfg. Company	94
Lincoln Electric Company	76
Link-Belt Company	10
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Michigan Alkali Co.	78
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Moretrench Corp.	90
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Quinn Wire & Iron Wks.	84
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Sika, Inc.	90
Solvay Sales Co.	78
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Trimont Mfg. Co.	91
Truscon Steel Co.	89
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